

# **Mineral and Extractive Key Resource Areas in Fitzroy and Livingstone Shires**

**by**

**B J Neville**

**Mineral and Extractive Planning Report 11  
February 2003**



**Queensland Government**  
**Natural Resources and Mines**

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## INTRODUCTION

Despite common perceptions, economic mineral deposits are relatively rare geological occurrences, which do not necessarily occur in convenient locations. Those of importance to the community need to be recognised and protected in land use planning instruments, so as to avoid their alienation by conflicting land uses. Extractive resources (quarry rock, construction sand and fill) are more common, but as high volume - low cost materials, they are sensitive to transport costs and are needed close to urban areas. There is great potential for conflict and planning protection is required to maintain their availability.

Over the last several years it has been widely recognised that improved input into land use planning is required to protect these resources and to reduce the potential for conflict between past, current and future mining and extractive industry and closer settlement.

Rockhampton is the main business centre for the central Queensland region, which has significant rural and mining industries. The Fitzroy and Livingstone Shires have a variety of mineral and extractive resources, including world class magnesite resources suitable for refractories and other industrial uses and feedstock for magnesium metal production, limestone for cement manufacture and other agriculture and industrial uses, salt, building stone (sandstone), oil shale, lateritic nickel and cobalt, gem quality chrysoprase and quarry rock, sand and gravel for general construction, concrete manufacture, road construction and railway ballast. All of these resources have significant regional importance. Some have strategic importance for value-adding industries, and their protection from conflicting land uses must primarily be achieved through the respective Shire's Planning Scheme.

### ***Statutory Framework for Planning and Administration of Mining and Extractive Industry***

Local Governments have responsibility for the preparation of planning instruments and the regulation of most land uses within their area according to those instruments. Land use proposals, requiring development applications for reconfiguration of allotments, material change of use or operational works, are approved under the Integrated Development Assessment System (IDAS) incorporated within the *Integrated Planning Act 1997* (IPA).

Extraction of sand, gravel and quarry rock (termed extractive materials), as distinct from minerals, is approved using the IDAS system, under a number of other statutes by various authorities, depending on background land tenure. The following summarises the situation: -

<i>On freehold land</i>	Local Governments (IPA)
<i>On leasehold land</i>	Queensland Parks and Wildlife Service of the Environmental Protection Agency and the Department of Primary Industries (Forestry) (resource allocation under the <i>Forestry Act 1959</i> ) and Local Governments (development approval under IPA)
<i>In non-tidal watercourses</i>	Department of Natural Resources and Mines ( <i>Water Act 2000</i> )
<i>In tidal watercourses</i>	Environmental Protection Agency ( <i>Marine Land Dredging By-law 1987</i> , soon to be via the <i>Coastal Protection and Management Act 1995</i> )

Environmental control of operations is administered by the Environmental Protection Agency (*Environmental Protection Act 1994*).

Mining projects on the other hand, from exploration programmes through to major mining developments, are approved separately through the provisions of the *Mineral Resources Act*

1989 (MRA), outside the IDAS system, because of their distinctive nature, large size and commercial significance. Environmental control is again under the *Environmental Protection Act 1994*.

The MRA provides for a number of tenures ranging from Prospecting Permits and Exploration Permits, through to Mineral Development Licences as holding tenures for feasibility studies, to Mining Leases that bestow a right to mine. The various tenures are summarised.

*Prospecting Permits* These are low-order exploration (and mining) tenures, which may be issued over a general area such as a mining district or more specific land parcels. They allow for the entry onto land for prospecting or for the pegging of a mining lease or mining claim, or for hand mining of minerals other than coal.

*Exploration Permits* These are the higher-order exploration tenures usually used by companies and include Exploration Permits for Coal (EPCs) and Exploration Permits for Minerals (EPMs); they allow the holders to explore over a specified area and under specified conditions.

*Mineral Development Licences* These may be taken out as a holding tenure for coal and minerals for the purposes of conducting further resource definition and investigating the feasibility of establishing a mine.

*Mining Claims* These are a lower level of mining tenure and permit only hand mining or prospecting.

*Mining Leases* These are the highest level of mining tenure and are required for the purpose of establishing and operating a mine; they may also be taken out to establish associated infrastructure. Leases are approved only after a rigorous process of assessment. Provisions include: -

- advertisement and public right of objection;
- impact assessment at an appropriate level;
- public hearing in the Land and Resources Tribunal; and
- compensation to be paid to landholders.

The separation of responsibility for planning of future land use and approvals for closer settlement on the one hand, and approval of mining developments on the other has sometimes contributed to a lack of co-ordination in decision making between Local Governments and the 'Mines' department of State Government. Whilst exploration and mineral discovery may be proceeding under the MRA, Local Government may be approving a conflicting development application on or adjacent to the identified deposit.

Such potential for land use conflict has only been partly addressed by provisions of the MRA (section 319). This affirms the overriding nature of the MRA approvals, and requires Local Governments to note granted Mining Leases and Mineral Development Licences on planning schemes. It also prohibits the amendment of a planning scheme where there is a mining lease or mineral development licence without the approval of the Minister, but such amendments no longer occur under IPA.

However, the MRA does not specifically provide for the *future protection of resources*, particularly those not yet under mining tenements, and such protection needs to be provided in Local Government planning schemes.

Consequently the Department of Natural Resources and Mines is now developing the concept of **Key Resource Areas (KRAs)**, which should be identified and protected by planning schemes so that the resources within them remain available for application for exploration and mining tenure in the future. Key Resource Areas are also appropriate to identify and protect major deposits of extractive resources such as sand and quarry rock, and this concept is being developed in the forthcoming State Planning Policy for the Protection of Extractive Resources.

### ***Scope and aims of this report***

This report was compiled at relatively short notice to co-ordinate with the preparation of the Fitzroy and Livingstone Shire planning schemes. As such it is not an exhaustive compilation of all resources in these shires, and concentrates on the most important deposits in terms of size and existing or potential economic impact so as to give advice to the Councils in a timely manner.

Eighteen Key Resource Areas or Potential Key Resource Areas are delineated around the important deposits, including separation distances from potentially incompatible land uses, and in some cases haul routes are also included. The resources are described briefly, the boundaries chosen explained, and recommendations given for planning protection.

Known deposits, particularly of magnesite, are of major commercial importance and although some are currently being mined, further deposits will need to be opened up now that the Stanwell magnesium metal plant is going ahead. Further Key Resource Areas may need to be delineated at some later stage.

Other deposits, including oil shale, limestone, nickel and cobalt are known, but as yet only limited commercial interest has been shown in them or definite plans for their development are not known at this point in time. These have been included in Potential Key Resource Areas so that any future exploitation remains possible but the status of these deposits may require further review at a later time.

Quarry rock resources included are limited to one site at Nerimbera, but the Shire Councils may be aware of other sites of local importance that should also be protected. Important known deposits of river sand or gravel are included, but extraction sites for these may change from time to time. Revision of the assessment of what constitutes a KRA in the district may need to occur in the future.

In the time available consultation with all interested parties on the KRAs has not been possible, but public input on the extent and recommendations for the KRAs will be possible when the new planning scheme is advertised.



## **THE KEY RESOURCE AREA CONCEPT**

The Key Resource Area (or Resource Precinct) concept was originally outlined in the Policy Paper on Minerals and Extractive Resources compiled for the SEQ 2001 planning exercise.

It has since been used to protect hard rock quarry resources in the Darlington Range south of Beenleigh, coal and extractive resources in Ipswich City, sandstone and quarry rock in Gatton Shire, and in a modified form, for quarry rock in Maroochy Shire and brick clay, sand and quarry rock in Noosa Shire. More recently, mineral and extractive resources in the Calliope Shire and in several Shires on the North Eastern Darling Downs have also been included.

The concept involves the protection of not merely the area where resources occur (as has been shown on Strategic Plans in the past), but also processing areas and transport routes (where required) and an area to provide adequate separation distances from potentially incompatible land uses. The concept also implies some level of scrutiny of environmental aspects of development of the resource and the use of a transport route for the transport of products.

Past Strategic Plan and Planning Schemes sometimes identified extractive industry sites as an extractive industry preferred dominant land use or extractive industry zone, but generally failed to provide for adequate separation between the resource and surrounding potentially incompatible land uses, or to delineate and protect an appropriate external transport route to a state controlled road.

The KRA concept aims to: -

- outline for protection the extent of significant resources, processing areas, the transport routes and appropriate separation distances from potentially incompatible land uses, not merely the geological extent of resources (see Diagram 1);
- by so doing, identify the area (the KRA) in which a higher level of development assessment will be triggered for potentially incompatible development;
- establish clear policies and procedures in statutory planning instruments to minimise the likelihood of potentially incompatible land uses establishing over or in the vicinity of extractive or mineral deposits and operations and their transport routes;
- incorporate preliminary consideration of environmental, social and cultural aspects of likely mining or quarrying before recommendations for a KRA are made; and
- incorporate more public input into planning decisions and inform existing and intending residents about the likely future mining or quarrying development in a district.

The goal is to delineate those deposits that have the potential not only to supply resources but also to do so in an environmentally, socially and culturally acceptable manner, and to inform the community of the criteria used for their selection.

A Key Resource Area is thus a place where potentially commercial resources are present and where preliminary planning and environmental considerations suggest that mining or quarrying might be acceptable, at least in part. It is hence an area where protection from intensification of settlement or other development is justified to allow future options of resource development to be considered.

A KRA is *not* a place where mining or extractive industry quarrying will be approved automatically. Such approval will require further resource definition and detailed examination of environmental, social and cultural impacts on a local, case by case basis as usual at the mining lease application, or extractive industry development application assessment stage.

The KRA concept does not aim to establish an inflexible exclusion zone in which all development is automatically excluded. Key Resource Areas are delineated over land zoned mainly for rural purposes and do not imply any loss of rights to continue rural activities as permitted under the planning scheme. However, they are areas where increased rights for intensification of settlement or development (particularly in the form of residential, rural residential, intensive animal husbandry or industrial development) are generally not appropriate or should only be allowed with conditions that protect the resources. Such protection may be achieved by requiring applicants for potentially incompatible land uses to demonstrate how the development may be designed to be compatible, for example by incorporating adequate self-protection measures if these are possible.

Two classes of Key Resource Areas are used. A definite Key Resource Area is where mining or extraction is currently occurring, can reasonably be expected to commence in the near future, or where resources have been defined to a high level of certainty. A Potential Key Resource Area is one where major resources are known but the definition of the resources or the practicality of working them are at a lower level of certainty and there are no plans to mine or quarry them in the foreseeable future.

The main difference in recommendations for these two categories is that applications for intensification of genuine rural activities in a Potential Key Resource Area should not be refused on the basis of the resources, but in a definite Key Resource Area, such applications should only be granted if it can be demonstrated that there is no impact on the mining/quarrying operation and vice versa. Third party referral to the Department of Natural Resources and Mines of development applications in both classes is encouraged. Potential Key Resource Areas should be reviewed at every review of the planning scheme.

Note that deposits within Key Resource Areas are identified as meeting the criteria for State or regional significance, and Local Governments should also examine the protection of deposits of more local significance, such as those in small quarries used for local road gravels and sands.

Local Governments should also be aware that because of the hidden, sub-surface nature of resources, not all deposits might have been located at a particular point in time. Further prospecting may locate other resources and result in potential conflicts with development applications elsewhere. Such development applications should not be approved automatically because they are not in a previously defined Key Resource Area. Key Resource Areas and other local resource areas in a local government area may need revision from time to time.

### ***Key Resource Area Boundaries.***

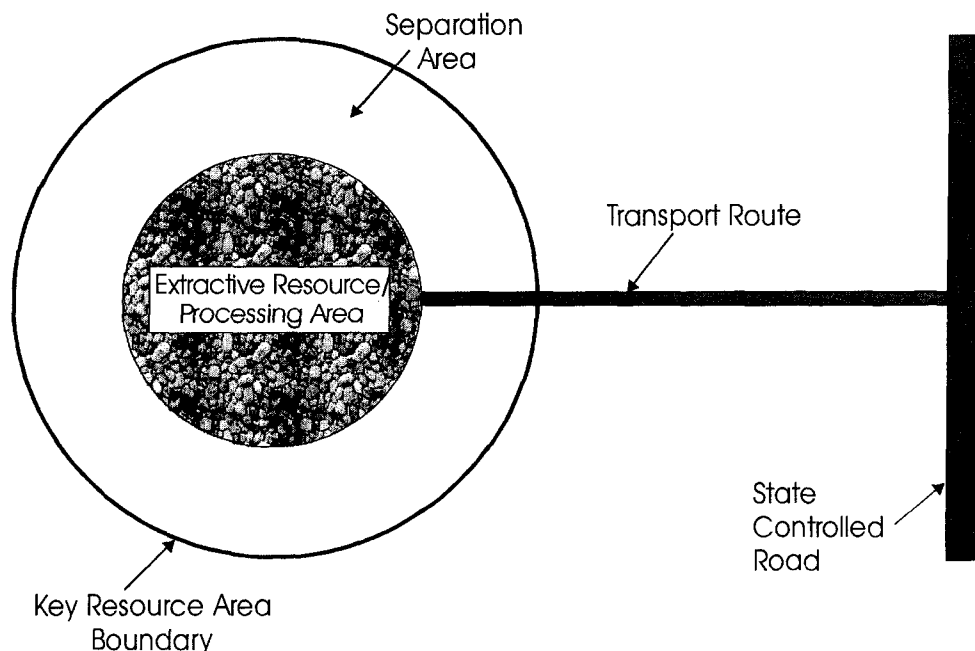
The appropriate separation distances from mining and extractive industry in the urban or semi-urban context has been examined by a number of authorities and varying separation distances have been adopted. For instance, the Western Australian Department of Planning and Urban Development in its Basic Raw Materials Policy Statement for the Perth Metropolitan Region adopted a separation distance of 2km. On the other hand, the Natural Resources and Environment working group of Victoria recommended a minimum separation distance of 500m from operating quarries and potential deposits. In the Darlington Range south of Beenleigh the then Department of Mines and Energy recommended a separation distance of 500m from existing quarries and potential resources (O'Flynn and others, 1996), but there the delineation of a separation distance was already constrained by existing residential and rural residential development.

In summary, whilst blast design and management techniques can permit a quarry or mine to operate within 500m of residential development, such a situation is far from optimal. In the

case of large open-cut mines there are also potential impacts from dust and noise, both from mine machinery and processing plants. A 500m distance is considered an absolute minimum for the acceptable separation of quarrying and mining from urban areas, with a distance of 1km recommended where possible.

The separation distances adopted in this study for the generation of Key Resource Area boundaries and the principles for applying them are: -

- a baseline separation distance of 1km from extent of the known resources or from the boundary of the current or proposed mining or extractive operation (including infrastructure), where the operation involves blasting and crushing;
- a 200m distance for mining and extractive resources or operations where blasting or intrusive processing is not involved, such as sand mining;
- where no resource has been defined, the separation distance to be taken from the boundary of the mining lease or mineral development licence or extractive industry approval area;
- modification of the boundaries following field inspection based on topographic conditions such as an intervening ridge or other feature permitting a lesser separation distance or a more topographically suitable position of the boundary;
- where residential, close rural residential development or industrial development already exists within the relevant separation distance, the KRA boundary excludes such developed areas from the KRA. Appropriate separation will need to be established within the resource adjacent to residential or rural residential settlement (and arrangements made with industrial owners), or the mining or extractive operation modified to achieve acceptable levels of impact on the adjacent sensitive land use;
- areas of significant surface mining disturbance, processing plants, stockpiles and areas under rehabilitation, are usually included within the KRA.



**Diagram 1: Elements of a Key Resource Area**



## **ULAM LIMESTONE /MARBLE**

### **Key Resource Area shown on Figure 1**

#### ***The Resource***

High quality white limestone or marble occurs on the Calliope Shire - Fitzroy Shire boundary at South Ulam 20km south of Bajool (Krosch, 1981). The deposit is in the Ginger Creek Member of the Raspberry Creek Formation and occupies a high ridge running south from Mount Kelly and Mount McCamley. The rock is coarse grained (as a result of recrystallisation from the heat of a nearby granitic body) and as such is not suitable for lime burning, but its high quality and whiteness makes it suitable for other industrial uses.

Use of the deposit has had a long history, dating back almost 100 years. In the past marble has been produced for monumental and dimension stone ('Ulam Carrara Marble') as well as for lime products. A history of the use of the deposit is given by Trezise (1990).

#### ***Current Status***

Omya Australia Pty Ltd, a subsidiary company of Pluess Staufer, which produces high-quality, white calcium carbonate from its mine, now holds a number of mining leases over the deposit. Milled products include stone dust for the underground coalmines of the Bowen Basin, and ground limestone for stock feed and agriculture. Blends of Ulam limestone and magnesite from Kunwarara north of Rockhampton meet the specific calcium and magnesium requirements for applications on sugar cane and other crops. The white limestone is also shipped to Omya's plant in Geelong in Victoria to supply the plastics, paint and paper industries (Department of Natural Resources and Mines, 2002a). No marble for monumental or dimension stone purposes are currently produced.

The sealed South Ulam Road is used for access to the mining operation and to transport product out to the Bruce Highway at Bajool.

#### ***Planning and Environmental Situation***

The resource is situated in an area of moderate to high relief in the vicinity of Mt Kelly and Mt McCamley, which is surrounded by mainly open cleared grazing land to the north, west and south. Whilst there is no immediate likelihood of closer settlement, small lot rural development could impact on the mining project and future mining operations. The South Ulam Road is flanked by rural properties.

#### ***Recommended Key Resource Area***

A Key Resource Area is recommended over the Ulam limestone resource. Most of the KRA lies within Fitzroy Shire, but some mining leases and the separation distance required on the eastern side is partly within Calliope Shire. The KRA has been delineated and recommended to the Calliope Shire Council in an earlier report by Willmott and Neville (2002).

No haul route has been designated because of low volumes of product transported.

#### ***Boundary of Key Resource Area***

The boundary of the Key Resource Area recommended covers mining leases on Mt Kelly and Mt McCamley and includes a separation distance of 1km to protect them from other conflicting land use. A lesser separation distance utilising ridge crests or the base of ridges, which may be mined on the other side, has been used wherever possible.

#### ***Outcomes Recommended for the Key Resource Area***

- (a) No constraints on rural activities currently permitted by the planning scheme, including new dwellings on existing rural lots;

- (b) Any intensification of *rural* activities which requires development approval for material changes of use, be subject to code or impact assessment to determine whether the proposed use can be carried out without detriment to the mining project or future access to the resource, and is suitable in itself in such a mining and mineral resource area;
- (c) No intensification of residential, rural residential or small lot rural settlement through reconfiguration of lots or material changes of use;
- (d) Any industrial development, other than that required or associated with the mining project, be subject to code or impact assessment to determine whether it can be carried out without detriment to the mining project or future access to the resource; and
- (e) Referral of development applications for (b), (c) and (d) above to the Department of Natural Resources and Mines for third party advice.

## **MARMOR LIMESTONE**

### **Key Resource Area shown on Figure 2**

#### ***The Resource***

At Marmor, a large deposit of limestone is located in the Redan Range immediately north of the North Coast Railway and the Bruce Highway. The deposit occurs within the Mount Alma Formation and it extends in a north/south direction cutting through a ridge, which has only low to moderate relief. Previous investigations of the deposit, including drilling were undertaken by Krosch and Kay (1977).

Whilst this deposit has been worked for many years, it is considered that remaining resources are adequate to support a moderate-sized quarrying operation at current extraction rates for the foreseeable future.

#### ***Current Status***

Two mining leases MLs 5763 and 5764 are held over the deposit by J Wells, operating as Wells Limeworks Pty Ltd, which produces mainly agricultural lime and product for environmental uses.

#### ***Planning and Environmental Situation***

The resource and mining leases are situated to the immediate north of the small township of Marmor, which is located between the Bruce Highway and the North Coast Railway. With the proximity of the area to Marmor, there is the possibility of gradually increasing small lot rural development in the area in future years, which if unplanned could impact on existing and future mining operations.

#### ***Recommended Key Resource Area***

A Key Resource Area is recommended over the Marmor limestone resource. The KRA is within the Fitzroy Shire.

No haul route has been designated because of the low volumes of product transported and the proximity of the Bruce Highway.

#### ***Boundary of Key Resource Area***

The northern boundary of the Key Resource Area is recommended at the full 1km from the northern most extent of Mining Lease No. 5764. The boundary extends almost to the Toonda-Port Alma Road and provides an appropriate separation distance from the existing quarry, which is more exposed from this direction. A lesser separation distance is appropriate on the eastern and western sides where ridge crests can be utilised. The southern boundary of the KRA is the mining lease boundary and Sisalana Road. The proximity of the quarry to the township of Marmor limits any separation here.

#### ***Outcomes Recommended for the Key Resource Area***

- (a) No constraints on rural activities currently permitted by the planning scheme, including new dwellings on existing rural lots;
- (b) Any intensification of *rural* activities which requires development approval for material changes of use, be subject to code or impact assessment to determine whether the proposed use can be carried out without detriment to the mining project or future access to the resource, and is suitable in itself in such a mining and mineral resource area;



- (c) No intensification of residential, rural residential or small lot rural settlement through reconfiguration of lots or material changes of use;
- (d) Any industrial development, other than that required or associated with the mining project, be subject to code or impact assessment to determine whether it can be carried out without detriment to the mining project or future access to the resource; and
- (e) Referral of development applications for (b), (c) and (d) above to the Department of Natural Resources and Mines for third party advice.

## **BAJOOL – PORT ALMA SALT**

### **Key Resource Areas shown on Figure 3**

#### ***The Resource***

A significant resource of salt occurs in natural brines at Bajool - Port Alma in the Fitzroy River delta. Salt is extracted from the brines as well as seawater in large evaporation ponds and is refined to produce a variety of salt grades, from table and cooking salt to bulk industrial salt. Most of Queensland's salt production is from salt works at Bajool and Bowen. The extraction of salt from solar salt fields is limited to a number of suitable sites around Australia and the value of this commodity is reflected by its wide range of uses and products supplied to national markets and for export. Hence the Bajool - Port Alma site is of strategic importance. The Bajool - Port Alma salt fields should thus be recognised in planning documents as Key Resource Areas.

#### ***Current Status***

Cheetham Salt Limited a wholly owned subsidiary of Ridley Corporation Limited is Australia's largest producer and refiner of salt and their Bajool - Port Alma Operations are located adjacent to Casuarina Creek and the Bajool - Port Alma Road. Pacific Salt Pty Ltd has operations between Casuarina Creek and the Bajool - Port Alma Road, which is within the harbour reserve controlled by the Rockhampton Port Authority. Current production for these operations is about 270,000 tonnes per annum and the maximum capacity of Cheetham's operation is around 650,000 tonnes per annum (A. Brown, Cheetham Salt Limited 2002, personal communication).

Salt is trucked to the bulk loading facility at Port Alma where it is loaded on to ships for transport to markets or is transported by road via the Bajool - Port Alma Road to the Bruce Highway. The rail connection from Port Alma to the North Coast Railway at Bajool has been dismantled.

#### ***Planning and Environmental Situation***

The salt works are situated on saline coastal flats adjacent to Casuarina and Raglan Creeks east of Bajool. The land is either Unallocated State Land, some of which is under grazing lease, or is reserve for harbour purposes. Although closer settlement is considered highly unlikely there, the possibility of other land use proposals within the area in the future cannot be ruled out.

#### ***Recommended Key Resource Areas***

The future of this type of operation appears assured as Cheetham Salt Limited has expansion plans to build a new refinery to replace the ageing existing refinery. The company has also indicated that to service the full potential of this industry it will require around 1.2 million tonnes per annum of salt, which will require an additional 5,000ha of land.

A Key Resource Area is recommended around the resource and infrastructure associated with the Cheetham Salt Limited and Pacific Salt Pty Ltd operations, and a Potential Key Resource Area is recommended for the area on Casuarina Island to the immediate north of the Bajool evaporator and an adjoining area to the west, pending further investigation there. The KRA and Potential KRA are situated within the Fitzroy Shire.

No haul route is necessary here as product is mainly transported to the nearby port bulk loading facility for shipment.

### ***Boundaries of Key Resource Areas***

The boundary is recommended at 200m from the extent of established evaporation ponds used for salt works and adjoining saline coastal flats that may have potential for future salt development so as to provide a separation distance from infrastructure associated with production, refining and loading operations. The northern and western limits of the Potential KRA are arbitrary at present, until more is known of the extent of the resources.

### ***Outcomes Recommended for the Key Resource Area***

- (a) No constraints on rural activities currently permitted by the planning scheme, including new dwellings on existing rural lots;
- (b) Any intensification of *rural* activities which requires development approval for material changes of use, be subject to code or impact assessment to determine whether the proposed use can be carried out without detriment to the salt works or future access to the resource, and is suitable in itself in such a resource area;
- (c) No intensification of residential, rural residential or small lot rural settlement through reconfiguration of lots or material changes of use;
- (d) Any industrial development, other than that required or associated with the salt works, be subject to code or impact assessment to determine whether it can be carried out without detriment to the salt works or future access to the resource; and
- (e) Referral of development applications for (b), (c) and (d) above to the Department of Natural Resources and Mines for third party advice.

### ***Outcomes Recommended for the Potential Key Resource Area***

- (a) No constraints on rural activities currently permitted by the planning scheme, including new dwellings on existing rural lots;
- (b) Because of the possible long time frames involved, no constraints also on any intensification of *rural* activities requiring development approval for material changes of use;
- (c) No intensification of residential, rural residential or small lot rural settlement through reconfiguration of lots or material changes of use;
- (d) Any industrial development, other than that required or associated with the salt works, be subject to code or impact assessment to determine whether it can be carried out without detriment to the salt works or future access to the resource;
- (e) Referral of development applications for (c) and (d) above to the Department of Natural Resources and Mines for third party advice; and
- (f) Review of the Potential Key Resource Area when the Fitzroy Shire Planning Scheme is next reviewed.



## **NERIMBERA QUARRY ROCK**

### **Key Resource Area shown on Figure 4**

#### ***The Resource***

Indurated sediments and volcanic rocks of the Berserker beds of Permian age form the steep hills and south-trending ridges in the foothills of the Berserker Range to the east of the city. The rocks are mainly indurated or hornfelsed sediments with several narrow andesitic dykes intruding the main sedimentary sequence. A resource of mainly dark grey argillite and interbedded greywacke occurs in hills between Black Creek and the Emu Park Road. It is the site of a major quarry of CSR Construction Materials Pty Ltd. Quarrying has shown that large volumes of suitable rock occur beneath clayey overburden up to about 9m depth, and that there is only limited variation in the rock. Large resources of rock of suitable quality remain in the quarry and on adjoining land to the south.

#### ***Current Status***

The present quarry is located in the eastern side of the Black Creek valley about 2km north east of Nerimbera siding. The quarry was initially worked by Sellars Quarries (Rockhampton) Pty Ltd (previously Capricorn Quarrying Pty Ltd) and is now operated by CSR Construction Materials Pty Ltd. It has several benches 15 to 20m high established in a south trending ridge. A full range of quarry products are produced, including road base, concrete aggregate, bitumen screenings, rail ballast, manufactured sand, drainage aggregate, armour rock and rip-rap and crusher dust. Large volumes are produced and the convenient location of the quarry and ability to supply a range of products makes the quarry of strategic significance to the development of the Rockhampton and wider central Queensland region.

The company holds a lease over freehold land on which the existing quarry is sited along with an adjacent block of leasehold land immediately to the east, which is used to buffer the quarry. The plant and stockpile area is sited on land owned by the company on the west side of Black Creek. Haulage of product is via the Nerimbera School Road to the Emu Park Road. Rail ballast is loaded for shipment at the Nerimbera rail siding.

The company also owns several freehold blocks between the present quarry and the Rockhampton - Emu Park Road. Plans for the future development of a proposed new quarry on this land and necessary approvals are well advanced. The company also holds some blocks surrounding this later resource for buffer purposes.

#### ***Planning and Environmental Situation***

To the northeast of the quarry close rural residential settlement has already been allowed at Meadow View Estate (10ha subdivision), but is buffered by the intervening ridges on the adjoining blocks held by the quarry operator. On the southwestern side of the quarry there are elevated rural residential blocks with houses as close as 500m to the quarry face, but they are not directly exposed to the face. Further to the west, rural residential blocks mainly occupy the Black Creek valley. From the north the existing quarry face is clearly visible, and vibration, noise and dust from quarrying operations is more likely there. From the south only the uppermost part of the quarry is visible but is buffered generally by the intervening ridges. However, if increased residential settlement were to occur in these areas it could have an adverse effect on the continued life of the quarry through increased complaints on noise etc.

The haul route along Nerimbera School Road is through rural residential and small-block rural settlement and passes the Nerimbera State School, and has been the subject of community concern. However, truck traffic on this road will eventually cease when the

proposed new quarry to the south becomes operational, as this will be accessed directly from the Rockhampton - Emu Park Road.

### ***Recommended Key Resource Area***

A Key Resource Area is recommended around the rock resource worked in the existing Nerimbera quarry and adjoining resources identified for future development to protect these from the possibility of increased settlement nearby. The KRA is within the Livingstone Shire.

Designation of a haul route is recommended from the existing quarry along Nerimbera School Road to the Rockhampton - Emu Park Road, including the existing access to the rail loading area at Nerimbera siding. No haul route needs to be shown for the proposed new quarry development as the company has indicated access will be established directly from the Rockhampton-Emu Park Road.

### ***Boundary of Key Resource Area***

The KRA recommended covers the existing quarry operation and includes associated infrastructure and rock resources. It also covers the proposed new quarry development, which is on adjoining land owned by the company.

The northern boundary is recommended a full 1km away from the existing quarry face because of the exposure of this area to the face. The western boundary utilises ridgelines where possible, either their crests or base. It extends down the crest of the ridge to the east of Scholler Road to Nerimbera School Road, and then continues across Black Creek to the base of the main north/south ridge in the vicinity of Stover Road and Black Creek Road. The separation here is less than the notional 1km distance from both the existing quarry face and the proposed new quarry development but intervening ridge crests provide the necessary protection here. The southern boundary is the base of the ridge along Black Creek Road about 500m from the proposed quarry development. To the southeast the separation distance is the greater of 1km from the proposed quarry face or 500m from the bund screening the proposed plant and stockpile area adjacent to Emu Park Road. The eastern boundary largely follows the base or crests of ridges where possible.

### ***Outcomes Recommended for the Key Resource Area***

- (a) No constraints on residential, rural residential or rural activities currently permitted by the planning scheme, including new dwellings on existing allotments;
- (b) Any intensification of *rural* activities which requires development approval for material changes of use, be subject to code or impact assessment to determine whether the proposed use can be carried out without detriment to the quarrying operation or future access to the resource, and is suitable in itself in such an extractive industry area;
- (c) No intensification of residential, rural residential or small lot rural settlement through reconfiguration of lots or material changes of use;
- (d) Any industrial development, other than that required or associated with the quarrying operation, be subject to code or impact assessment to determine whether it can be carried out without detriment to the quarry or future access to the resource; and
- (e) Referral of development applications for (b), (c) and (d) above to the Department of Natural Resources and Mines for third party advice.

***Outcomes Recommended for the Haul Route from the Existing Quarry***

- No construction of new residential dwellings within 100m from the road boundary unless it can be demonstrated that they are compatible with the haulage operation or siting within that distance is essential or unavoidable.

## **PINK LILY – FITZROY RIVER SAND**

### **Key Resource Area shown on Figure 5**

#### ***The Resources***

A significant resource of fine to coarse-grained sand and gravel occurs in deposits both in-stream and off-stream in the Pink Lily area just west of the city. The sand occurs in point bar and channel deposits in the river and in deposits associated with lower and intermediate terraces of the river, which are overlain by a variable thickness of overburden. River sand and gravel from this area is the main source of supply for the Rockhampton region and is used primarily for construction purposes, mainly concrete aggregate. Detailed descriptions of workings and sources of sand and gravel associated with the Fitzroy River are given by Trezise and others (1983).

#### ***Current Status***

There is currently one in-stream sand operation in the Fitzroy River at Pink Lily operated under a Controlled Quarry Material permit issued to J M Kelly (Builders) Pty Ltd, trading as Pink Lily Sands Pty Ltd. Sand and gravel is dredged from the river channel by a floating suction dredge and is pumped some distance to a processing plant on the bank of the river at the northern end of Pink Lily Road. The company has previously dredged sand from large pits adjacent to their processing plant but the pits are now mainly used to settle waste water from the plant before discharging it back into the river. The company has lodged a Development Application for Material Change of Use (Sand Processing Plant) with the Fitzroy Shire Council to relocate their plant from the present site to a new site adjacent to the river further down Pink Lily Road towards Ridgeland Road.

Sand has also been produced for use as bricklayers loam, binder and bedding sand from pits in deposits on the lower alluvial terrace between Lilymere Lagoon and the Fitzroy River.

Sand is also worked intermittently from large deposits on terraces adjacent to the river on the north side about 3.5km southwest of its junction with Ramsay Creek. Medium to coarse-grained sand is excavated to a depth of about 3m. Reserves are large and replenishment occurs during periods of major flooding. The deposits are located on private land, which is used for grazing purposes with the only access being from Belmont Road.

#### ***Planning and Environmental Situation***

The resource occurs within either the bed of the Fitzroy River or adjacent terraces on mainly rural land. On the north side of the river most of the land is private and is used for grazing purposes. However, closer settlement already exists at Glenmore and further subdivision could be possible. To the west near Lilymere Lagoon the land is mostly rural. The Pink Lily area to the east is again largely rural or small-block rural. Much of the land is flood prone and would be unsuitable for closer settlement.

#### ***Recommended Key Resource Area***

Given the importance of these resources as the major source of construction sand for the Rockhampton region, Key Resource Area status is recommended. The KRA includes both in-stream and off-stream deposits and it mainly lies across the boundary of Fitzroy and Livingstone Shires. The northeastern boundary partly extends into the City of Rockhampton.

A haul route is designated from the existing sand processing plant at the end of Pink Lily Road to the Ridgeland Road. No haul route has been shown from the deposits on private land

either on the northern side of the river as the only access is directly onto the major Belmont Road, or at Lilymere Lagoon where the volumes transported is not large.

### ***Boundaries of Key Resource Area***

The boundary is recommended at 200m from the extent of known and potential sand resources both in-stream and off-stream that are currently being worked or have previously been worked. It also extends from existing or proposed processing plants and other infrastructure (stockpile areas, maintenance areas, water works etc) to provide a separation from noise associated with production, processing and loading operations.

The western boundary extends from near the boat ramp at the end of Ski Gardens Road downstream to Ridgeland Road. It covers lower terrace deposits between the river and Lilymere Lagoon and includes the area known as Sandy Island. The southern boundary continues around Pink Lily Bend and includes the proposed sand processing plant site between the river and Pink Lily Road. The eastern boundary covers possible potential sand resources between Pink Lily and Six Mile Roads, which may be present in the same higher terrace that contains deposits being worked in the pit at the end of Pink Lily Road. It continues around the existing pit along the river towards Picnic Point. At Picnic Point the area is currently Recreation Reserve and includes a motor-cross track so any potential deposits in the lower terrace there would be unavailable for exploitation. The northern boundary encompasses the lower and middle terraces on the north side of the river opposite the Pink Lily Bend and extends from the junction of Ramsay Creek upstream to opposite Ski Gardens Road.

### ***Outcomes Recommended for the Key Resource Area***

- (a) No constraints on rural activities currently permitted by the planning scheme, including new dwellings on existing rural lots;
- (b) Any intensification of *rural* activities which requires development approval for material changes of use, be subject to code or impact assessment to determine whether the proposed use can be carried out without detriment to the quarrying operation or future access to the resource, and is suitable in itself in such an extractive industry area;
- (c) No intensification of residential, rural residential or small lot rural settlement through reconfiguration of lots or material changes of use;
- (d) Any industrial development, other than that required or associated with the quarrying operation, be subject to code or impact assessment to determine whether it can be carried out without detriment to the quarry or future access to the resource; and
- (e) Referral of development applications for (b), (c) and (d) above to the Department of Natural Resources and Mines for third party advice.

### ***Outcomes Recommended for the Haul Route***

- No construction of new residential dwellings within 100m from the road boundary unless it can be demonstrated that they are compatible with the haulage operation or siting within that distance is essential or unavoidable.

## **STANWELL SANDSTONE**

### **Key Resource Area shown on Figure 6**

#### ***The Resource***

Sandstone suitable for building stone and monumental work has been quarried near Stanwell since the early 1880s and has been used in many of the public buildings in Rockhampton. Large resources of medium-grained, light brown sandstone occur in the Early Jurassic Razorback beds. Sandstone from this quarry is being used for restoration work in Sydney.

#### ***Current Status***

The larger part of the resource is held under Mining Lease No. 7341 and Mining Lease No. 80102 (Application) and Exploration Permit for Minerals No. 11530 by Capricorn Stone Products Pty Ltd. Sandstone blocks are quarried using traditional quarrying methods without the use of explosives. The blocks are processed on site.

#### ***Planning and Environmental Situation***

The land surrounding the mining leases is used mainly for grazing purposes or potential industrial development. The Stanwell power station is located a short distance further along Power Station Road and the site for the Australian Magnesium Corporation Limited magnesium metal plant is located immediately adjacent to the power station.

#### ***Recommended Key Resource Area***

In view of both past and present use of this particular sandstone as a building stone in historic buildings and more recently for renovation works here and interstate, the deposit remains an important source, and protection is warranted for the longer term although only small volumes are produced. The quarry operators have also indicated plans for the redevelopment of the quarry to further increase production and processing capabilities. Thus, a Key Resource Area is recommended over the generalised geological resource area and existing mining tenures. The KRA lies within the Fitzroy Shire.

The existing access to the quarry is located at the northern corner of the mining lease off Power Station Road, which connects to the Capricorn Highway near Stanwell. No haul route is designated, as the volumes of stone transported are relatively small.

#### ***Boundaries of Key Resource Area***

A separation distance of 200m from the mining lease boundary is recommended to provide a suitable distance for noise and dust from quarrying and processing operations and from stockpile and loading areas.

#### ***Outcomes Recommended for the Key Resource Area***

- (a) No constraints on rural activities currently permitted by the planning scheme, including new dwellings on existing rural lots;
- (b) Any intensification of *rural* activities which requires development approval for material changes of use, be subject to code or impact assessment to determine whether the proposed use can be carried out without detriment to the quarrying operation or future access to the resource, and is suitable in itself in such an extractive industry area;
- (c) No intensification of residential, rural residential or small lot rural settlement through reconfiguration of lots or material changes of use;

- (d) Any industrial development, other than that required or associated with the quarrying operation, be subject to code or impact assessment to determine whether it can be carried out without detriment to the quarry or future access to the resource; and
- (e) Referral of development applications for (b), (c) and (d) above to the Department of Natural Resources and Mines for third party advice.



## **MOUNT ETNA LIMESTONE**

### **Key Resource Area shown on Figure 7**

#### ***The Resource***

Limestone resources are known in a number of localities in the Rockhampton district (Krosch and Kay, 1977). In The Caves area to the north of Rockhampton very large resources of limestone occur in deposits on Mount Etna and Limestone Ridge. The Mount Etna deposit occupies the northern part of the mountain and quarries have been developed in the eastern and western sections. The central section of the deposit is highly cavernous with important bat populations and is now covered by National Park. The quality is high with a CaO content of 54%. Much of the remaining available limestone on the mountain has been secured under mining leases by Queensland Cement Limited (QCL) for long term supply of limestone for the manufacture of lime and speciality white cement at QCL's Parkhurst plant north of Rockhampton.

#### ***Current status***

Queensland Cement Limited has established a major mine on Mount Etna to supply its cement plant at Parkhurst. This is the closest limestone resource of suitable high quality in the Rockhampton area and is held by the company under Mining Lease No's. 5765, 5766, 5767, 5768 and 5804. Material is crushed on site and transported by road along Rossmoya Road and the Bruce Highway to the lime and cement works at Parkhurst. Exploration Permit for Minerals No. 13112 held by QCL also covers the area over the resource.

#### ***Planning and Environmental Situation***

Mount Etna is a prominent feature of moderate relief, roughly circular in shape, which is bounded by Rossmoya Road to the east and the North Coast Railway at its western and southwestern extremities. The original old quarry faces are sited on the lower slopes on the eastern side of the mountain and extend around to the northeast. The existing crushing plant and other infrastructure is also located on the eastern side adjacent to Rossmoya Road. Over the years mining operations have steadily progressed around the northwest and western side of the mountain.

There was considerable opposition to the mine in the early days of development, particularly on the issue of the possible effects quarrying would have on the Bent Wing Bat population and the caves in the central part of the mountain. The matter was eventually resolved with quarrying ceasing on the eastern face in favour of a new quarry on the western side and the central section being gazetted as National Park. A large portion of the original resource became unavailable but access remained to sufficient resources to supply the requirements of the company's plant at Parkhurst. However, increased demand for lime products in recent years and the depletion of workable resources may necessitate expansion or redevelopment of the quarry northwards onto other private land to meet future requirements.

The land surrounding this deposit is largely freehold rural blocks and further subdivision of these appears unlikely in most places (although not impossible) as it would create blocks smaller than that allowed by the Council in rural areas. Queensland Cement Limited owns the land on the eastern side of the mountain (partly under mining lease). The central part of the mountain is National Park with Unallocated State Land situated to the immediate east, north and west of the National Park, which the company presently holds under mining lease. A further mining lease is held on the adjoining freehold land to the west.

### ***Recommended Key Resource Area***

Clearly the continued supply of limestone to maintain operations at the Parkhurst plant is important. Hence the Mount Etna limestone being the closest high quality resource to Rockhampton remains of economic significance for the medium to long term. Consequently a Key Resource Area around the limestone resource and current mining tenures is recommended for protection from conflicting land uses. The KRA is situated in Livingstone Shire.

No haul route is designated, as Rossmoya Road is a significant arterial road continuing to Rossmoya and other areas and connects to the Bruce Highway at The Caves.

### ***Boundaries of Key Resource Area***

The Department does not hold detailed information on the location of the workable limestone resource to the north of the present quarries. Hence the Key Resource Area has been recommended in consideration of current mining operations and potential extensions to the north for vibration, noise and dust, with a basic separation distance of 1km, modified however by local topography where possible.

On the eastern side of the KRA, the land east of Rossmoya Road is National Park. Both here and to the northeast the boundary is extended out the full 1km from the known resource. Similarly, to the north and northwest the boundary is the maximum distance to provide a suitable separation for vibration, noise and dust from existing quarrying operations and any future extensions. On the western side, the North Coast Railway, which is located slightly less than the maximum 1km is considered to provide an adequate separation from resources and mining activity. To the southwest and south, the railway is again used along with the intervening low ridges adjacent to the railway to provide a suitable separation. These ridges also contain extensive gravel scrapings used for road construction materials. It is considered unlikely for mining to extend any further south, as suitable resources are limited. A lesser separation distance is acceptable there.

These boundaries are considered adequate to protect resources at this point in time but may need further revision if resources are better defined or mining plans are advanced forward which may alter the current configuration.

### ***Outcomes Recommended for Key Resource Area***

- (a) No constraints on rural activities currently permitted by the planning scheme, including new dwellings on existing rural lots;
- (b) Any intensification of *rural* activities which requires development approval for material changes of use, be subject to code or impact assessment to determine whether the proposed use can be carried out without detriment to the quarrying operation or future access to the resource, and is suitable in itself in such an extractive industry area;
- (c) No intensification of residential, rural residential or small lot rural settlement through reconfiguration of lots or material changes of use;
- (d) Any industrial development, other than that required or associated with the quarrying operation, be subject to code or impact assessment to determine whether it can be carried out without detriment to the quarry or future access to the resource; and
- (e) Referral of development applications for (b), (c) and (d) above to the Department of Natural Resources and Mines for third party advice.

## **YAAMBA OIL SHALE/MAGNESITE/NICKEL**

### **Potential Key Resource Area shown on Figure 8**

#### ***The Resources***

Oil shale deposits have been identified in a number of small Tertiary basins in eastern Queensland, including Herbert Creek and Yaamba Basins. The oil shales were deposited in shallow freshwater lacustrine environments as part of a Tertiary sedimentary sequence essentially comprising oil shale, claystone and sandstone. The Yaamba Basin extends beneath the topographically low country westward from the small township of Yaamba on the Bruce Highway northwest of Rockhampton. The deposit contains 2.8 billion barrels of oil in situ at 98 litres per tonne on a total water-free basis (Southern Pacific Petroleum NL Annual Report, 2001). Potential economic resources of the oil shale straddle the North Coast Railway, the Bruce Highway and Fitzroy River.

If economic, environmental and social constraints can be overcome; shale oil could provide an opportunity for long-term resource security for Australia as conventional resources of petroleum decline. Most of the oil shale resources are in Queensland.

During exploration in the Yaamba Basin, large shallow deposits of magnesite were discovered in Quaternary and weathered Tertiary sediments that overlie the oil shale sequence. The deposit contains some 100Mt of magnesite (Department of Natural Resources and Mines, 2002d) and is similar to the Kunwarara deposit to the immediate northwest in the adjoining Herbert Creek Basin.

In the Canoona area, two separate lateritic nickel deposits similar to those in the Marlborough area were identified during earlier exploration undertaken there. They contain high grades of nickel and cobalt and are furthestmost to the east of the Marlborough deposits within the serpentinite belt. The Brolga deposit has already been mined by QNI Resources Pty Ltd; the ore was railed to the Yabulu refinery near Townsville for processing. The deposits are held under mining tenure by QNI Resources, but any future development plans are not known. However, the deposits could provide additional resources for the Marlborough Nickel Project and further interest could be shown in them.

#### ***Current Status***

Large-scale commercial production of shale oil is now being trailed in Queensland at the Stuart deposit near Gladstone by Southern Pacific Petroleum NL, using AOSTRA Taciuk Processor (or ATP) technology adapted for oil shale processing by Southern Pacific Petroleum since 1986.

At Yaamba, the broader resource area and surrounds are held by Southern Pacific Petroleum NL under Exploration Permit for Minerals No. 3470 and Mineral Development Licence No. 302 (Application). These exploration and development tenements are likely to be retained until all mining leases required for any future project are granted.

Anglogold Australia Magnesite Pty Ltd holds the Yaamba magnesite deposit under Mineral Development Licence No. 195. Southern Pacific Petroleum also holds most of the area under Exploration Permit for Minerals No. 3470. Exploration Permit for Minerals No. 9728 held by Australian Magnesium Corporation Limited overlaps a small part of the deposit in the north.

The lateritic nickel deposits are held under Mining Lease No's. 5866 (Brolga), 7048 and 5864 (Canoona) by QNI Resources Pty Ltd and the area is covered by Exploration Permit for Minerals No. 11195 held by Marlborough Nickel Pty Ltd. Although the Brolga deposit has

already been mined, it is possible that further production may come from these deposits sometime in the future.

### ***Planning and Environmental Situation***

The resources are situated in a rural environment of mostly grazing land and there is no immediate likelihood of closer settlement. The township of Yaamba is just to the east of the oil shale resource and adequate separation and screening will have to be maintained between the town and any future development. The main northern transport corridor, which includes the highway and main railway, will also need an adequate separation distance from any future development of the magnesite and oil shale resources. The oil shale resource also extends across the Fitzroy River.

### ***Recommended Key Resource Area***

If the exploitation of the oil shale proves feasible, this deposit and other Queensland oil shale resources will be of long term State and national significance, and protection of them from conflicting land uses that could sterilise them is required. Similarly, the magnesite deposit is a significant future source of raw material for both magnesia and magnesium metal production.

Consequently, a Potential Key Resource Area is now proposed to protect the availability of these resources for the future. The PKRA recommended is intended to protect the known oil shale and magnesite resources for possible future exploitation. It also includes the Brolga and Canoona lateritic nickel deposits currently held under mining lease. The Brolga deposit has already been mined but further exploitation of remaining resources in both deposits is still possible sometime in the future. The PKRA is largely within Livingstone Shire, but extends partly into the Fitzroy Shire in the south.

### ***Boundaries of Potential Key Resource Area***

The Potential Key Resource Area recommended here includes a separation distance about 1km from the extent of known resources and current mining tenures to provide for any operations that are likely to be large-scale mining. However, at Yaamba the PKRA boundary is located to the immediate west of the township where it coincides with that of Mineral Development Licence No. 302 (Application).

### ***Outcomes Recommended for the Potential Key Resource Area***

- (a) No constraints on rural activities currently permitted by the planning scheme or on new dwellings on existing lots;
- (b) Because of the long time frames involved, no constraints also on any intensification of *rural* activities requiring development approval for material changes of use;
- (c) Any industrial development, other than associated with future mining, be subject to code or impact assessment to determine whether it can be carried out without detriment to a future mining project or future access to the resource;
- (d) No intensification of residential, rural residential or small lot rural settlement through reconfiguration of lots or material changes of use; and
- (e) Referral of any development applications for (c) and (d) above to the Department of Natural Resources and Mines for third party advice.

## **KUNWARARA MAGNESITE**

### **Key Resource Area shown on Figure 9**

#### ***The Resource***

The large Kunwarara magnesite deposit is located adjacent to the Bruce Highway, 65km northwest of Rockhampton. It occurs in a shallow Tertiary sedimentary basin, which covers an area of about 63km<sup>2</sup>. The deposit is one of three semi-continuous deposits (Yaamba, Kunwarara and Herbert Creek) that have been recognised in the Yaamba Basin and Herbert Creek Basin which stretch from Yaamba to Broad Sound, a distance of about 60km. The magnesite is derived from weathering and erosion of serpentinite and other ultramafic rocks in adjacent hills, with the magnesium being transported in solution in groundwater and later precipitated as magnesite nodules in a Tertiary/Quaternary fluvial sequence (Wilcock, 2000). The deposits are located in topographically low areas, and the sedimentary sequence containing the magnesite is overlain by black clay soils up to about 4m thick.

In 1985, Queensland Metals Corporation Ltd (now Australian Magnesium Corporation Limited) discovered this significant deposit of cryptocrystalline magnesite following investigations of the area and it is the largest known deposit of this type in the world. The average MgO content of the deposit is high at 93.5%.

#### ***Current Status***

The Kunwarara deposit is held under a number of mining tenements by Australian Magnesium Corporation Limited. Current mining leases are MLs 5869, 5870, 5868 and 80067. Mineral Development Licence No. 344 (Application) covers most of the deposit and Mineral Development Licence No. 256 is held over the Oldman South part of the deposit. The surrounding area is held under Exploration Permit for Minerals No. 9728. The deposit contains an inferred resource around 400Mt of magnesite and proved and probable reserves of 118.6Mt of ore containing 33.7Mt of magnesite (Department of Natural Resources and Mines, 2002d). The deposit continues to the southeast into the adjoining Yaamba deposit, which contains a further 100Mt of magnesite (see Yaamba PKRA) and to the north into the Herbert Creek deposit (see Herbert Creek PKRA). Mining commenced at Kunwarara in 1991 and some 20.5Mt of ore has been won to the end of 1999. Current production of ore is around 3Mtpa producing about 400 000t of magnesite (Wilcock, 2000).

Mining is presently undertaken at two sites, KG1 and KG2 using open-cut methods in individual pits containing about 0.5Mt of ore. The KG1 mine is located in the northern part of the deposit within Mining Lease No's. 5868 and 80067 and the KG2 mine is in the central part within Mining Lease No. 5870. The run of mine ore is processed at the mine to upgrade it to acceptable quality. Primary beneficiation of the magnesite involves crushing, screening, separation and sorting. It is then transported by truck to the magnesia processing plant at Parkhurst on the northern outskirts of Rockhampton. Here, the magnesite is first converted to calcined magnesia, which is used as feedstock for processing into deadburned magnesia and electrofused magnesia. The main use of magnesia is in high-grade refractory applications, mainly by the steel industry. Other important uses are as industrial fillers and chemicals in agricultural and environmental applications, and as a flame retardant.

More recently, the development of lightweight metals technology and the commencement of the Stanwell Magnesium Project, using magnesite feedstock from this mine, confirm the importance of this deposit to Australia.

### ***Planning and Environmental Situation***

The resource is situated in a rural setting, mostly grazing land and there is no immediate likelihood of closer settlement.

### ***Recommended Key Resource Area***

The convenient location of the Kunwarara deposits to existing road and rail infrastructure means that those resources can be easily transported to Rockhampton and will continue to be of significance to the operations of the existing magnesia plant at Parkhurst and the new magnesium metal plant at Stanwell. Whilst the land is currently used for grazing purposes and conflicting land uses near the deposits are unlikely, their importance as a source of raw materials for a major national industry requires these deposits be recognised as a Key Resource Area. The KRA is within the Livingstone Shire.

The proximity of the Bruce Highway to the mine site allows ore to be trucked out by way of the dedicated access to the mining lease and no haul route needs to be designated at this stage.

### ***Boundaries of Key Resource Area***

The Key Resource Area recommended primarily covers the extent of known resources, existing mining tenures and the greater part of the geological extent of the sedimentary sequence that hosts the mineralisation. Mining operations are open cut and no blasting is required. A standard separation distance of 1km from the periphery of resources and mining tenures has been used as the open and mainly flat topography provides little protection from any noise or dust associated with such large-scale mining operations being undertaken here.

### ***Outcomes Recommended for the Key Resource Area***

- (a) No constraints on rural activities currently permitted by the planning scheme, including new dwellings on existing rural lots;
- (b) Any intensification of *rural* activities which requires development approval for material changes of use, be subject to code or impact assessment to determine whether the proposed use can be carried out without detriment to the mining operation or future access to the resource, and is suitable in itself in such an mining area;
- (c) No intensification of residential, rural residential or small lot rural settlement through reconfiguration of lots or material changes of use;
- (d) Any industrial development, other than that required or associated with the quarrying operation, be subject to code or impact assessment to determine whether it can be carried out without detriment to the mining operation or future access to the resource; and
- (e) Referral of development applications for (b), (c) and (d) above to the Department of Natural Resources and Mines for third party advice.

## **HERBERT CREEK OIL SHALE AND MAGNESITE**

### **Potential Key Resource Areas shown on Figure 10**

#### ***The Resources***

The Herbert Creek Basin is located to the northwest of Rockhampton and is one of a number of small Tertiary basins situated adjacent to the eastern coastline of Queensland that contain oil shale and magnesite deposits. It contains a sedimentary sequence largely comprising interbedded oil shale, claystone and sandstone. The oil shale occurs at shallow depth both in the Boundary Flat Lagoons deposit in the northern part of the basin and the Block Creek deposit in the south. It is estimated that these deposits contain in situ resources of 0.7 billion barrels of shale oil at a grade of 77 litres per tonne and 0.5 billion barrels of shale oil at 98 litres per tonne respectively (Southern Pacific Petroleum NL Annual Report, 2001). Along with the Yaamba oil shale deposit to the southeast, these deposits could have major economic significance in the future. Magnesite also occurs in the Tertiary sedimentary sequence and deposits extend from Yaamba through to the Herbert Creek area. The Glenprairie magnesite deposit occurs in the southern or southwestern part of the basin. This deposit along with other similar deposits in the area may also be of future economic interest.

#### ***Current Status***

The oil shale deposits are held under Mineral Development Licence No. 196 and 197 and Exploration Permit for Minerals No. 3469 by Southern Pacific Petroleum NL.

Anglogold Australia Magnesite Pty Ltd holds the Glenprairie magnesite deposit under Mineral Development Licence No. 194.

#### ***Planning and Environmental Situation***

The land containing these deposits is relatively low lying and used for grazing purposes. There is no immediate likelihood of closer settlement here. The Commonwealth Shoalwater Bay Military Training Area bound the deposits on their eastern side. Any exploitation of deposits that may extend into the military training area would not be possible because the land in effect is already sterilised, as the landowner would invariably disallow access for mining.

#### ***Recommended Potential Key Resource Area***

Since there is no current development plans for these resources, only Potential Key Resource Area status is recommended so that the deposits are recognised to avoid any possibility of sterilisation by conflicting land uses. Three separate areas are recommended. Revision may be necessary should development proceed at some stage later. All three PKRAs are within the Livingstone Shire.

#### ***Boundaries of Potential Key Resource Areas***

##### ***Block Creek Potential Key Resource Area***

The Block Creek Potential Key Resource Area covers most of the known, potentially economic oil shale resource in this part of the Herbert Creek Basin. As there are no definite plans to exploit any particular deposit as yet, it is difficult to determine an appropriate separation distance from likely operations.

Accordingly, the area recommended includes the extent of known resources within Mineral Development Licence No. 197 with a separation distance of 1km from the resource. Potential resources extending into the Shoalwater Bay Military Training Area to the immediate east of the PKRA are already sterilised and unavailable for exploitation.

##### ***Boundary Flat Lagoons Potential Key Resource Area***

The Boundary Flat Lagoons Potential Key Resource Area includes the known oil shale resource in the northern part of the basin within Mineral Development Licence No.196. The boundary of the PKRA could be revised if more definite plans for exploitation materialise



later. Again, the eastern boundary has been largely determined by the military training area, which already sterilises any potential resource on that land.

**Glenprairie Potential Key Resource Area**

Exploration has determined the existence of a magnesite deposit here, which may be an important future source in addition to other deposits in the area. The Department does not hold specific details on the extent of the deposit or plans for possible development at this stage. The PKRA recommended covers land within Mineral Development Licence No. 194.

***Outcomes Recommended for the Potential Key Resource Areas***

- (a) No constraints on rural activities currently permitted by the planning scheme or on new dwellings on existing lots;
- (b) Because of the long time frames involved, no constraints also on any intensification of *rural* activities requiring development approval for material changes of use;
- (c) Any industrial development, other than associated with future mining, be subject to code or impact assessment to determine whether it can be carried out without detriment to a future mining project or future access to the resource;
- (d) No intensification of residential, rural residential or small lot rural settlement through reconfiguration of lots or material changes of use; and
- (f) Referral of any development applications for (c) and (d) above to the Department of Natural Resources and Mines for third party advice.

## **MARLBOROUGH MAGNESITE**

### **Potential Key Resource Area shown on Figure 11**

#### ***The Resource***

The occurrence of magnesite in the Marlborough area has been known for some time but as some earlier attempts at mining were unsuccessful there was little commercial interest shown in these occurrences. However, the discovery of the Kunwarara magnesite deposit in the 1985 saw a renewal of interest and exploration efforts, which resulted in the identification of magnesite deposits west and southwest of the township of Marlborough. They contain inferred resources of 77Mt (Department of Natural Resources and Mines, 2002d). Whilst these deposits are much smaller and are more complex in nature than the Kunwarara deposits the likelihood of commercial exploitation in the future cannot be ruled out.

#### ***Current Status***

Australian Magnesium Corporation Limited holds the resource under Mineral Development Licence No. 120. Omya Australia Pty Ltd holds two mining leases MLs 5871 and 5844 over small outliers in the southernmost part of the resource.

#### ***Planning and Environmental Situation***

The resource is situated in a rural area and the land is used mainly for grazing purposes. The township of Marlborough is just to the east but there is no immediate likelihood of closer settlement. The small lot subdivision south of the resource is the old Marlborough township site but it is now largely incorporated into surrounding rural land.

#### ***Recommended Potential Key Resource Area***

A Potential Key Resource Area is recommended to recognise the deposit to avoid possible sterilisation from conflicting land uses. Plans for any future exploitation of the deposit are not known at this stage. The PKRA is within the Livingstone Shire.

#### ***Boundaries of Potential Key Resource Area***

The boundary of the Potential Key Resource Area recommended includes the extent of known resources within Mineral Development Licence No. 120, the two small deposits to the east and the two mining leases to the south. It also includes a separation distance of 1km around the resource.

#### ***Outcomes Recommended for the Potential Key Resource Area***

- (a) No constraints on rural activities currently permitted by the planning scheme or on new dwellings on existing lots;
- (b) Because of the long time frames involved, no constraints also on any intensification of *rural* activities requiring development approval for material changes of use;
- (c) Any industrial development, other than associated with future mining, be subject to code or impact assessment to determine whether it can be carried out without detriment to a future mining project or future access to the resource;
- (d) No intensification of residential, rural residential or small lot rural settlement through reconfiguration of lots or material changes of use; and
- (g) Referral of any development applications for (c) and (d) above to the Department of Natural Resources and Mines for third party advice.

## **MARLBOROUGH NICKEL/COBALT/CHRYSTOPRASE**

### **Key Resource Area shown on Figure 12**

#### ***The Resources***

Identified mineral resources occurring in the Marlborough area include extensive lateritic nickel and cobalt deposits, and chrysoprase deposits. These are located about 20km south of Marlborough township within a suite of ultramafic rocks comprising mainly serpentinite and serpentinitised harzburgite with associated dunites and pyroxenites. These rocks generally form high, sharp-crested ridges with dissected spurs, with the intervening flat areas being underlain by the same rocks as well. The weathered, mineralised profile is variable in thickness and may be up to about 70m deep. During the Tertiary, lateritic profiles developed over these rocks with accompanying silicification and nickel/cobalt enrichment within the laterite and underlying saprolites. Cainozoic faulting and erosion resulted in the removal of much of the laterite.

Detailed exploration first undertaken in the 1960s and other investigations since have identified an overall resource of 210Mt at 1.02% nickel and 0.06% cobalt in a number of separate deposits. The only mining undertaken was at the Brolga deposit in the Canoona area from 1993 to 1995 by QNI Resources Pty Ltd. Some 620,000t of screened ore averaging 1.59% nickel and 0.14% cobalt was mined and railed to the Yabulu refinery near Townsville for processing (Department of Natural Resources and Mines, 2002b). There are a number of other deposits but their low grades have precluded mining to date.

Gem quality chrysoprase, a variety of chalcedony, was first discovered at Marlborough in the early 1960s and has been mined there commercially since. Chrysoprase occurs within the same laterite profile as the nickel mineralisation. It is an important ornamental stone used mainly in jewellery and carvings and is supplied to world gem markets (Department of Natural Resources and Mines, 2002c). The quality of stone and ability to maintain supply are major factors, which make the deposit an important world source of this gemstone.

#### ***Current Status***

The lateritic nickel deposits are currently held under a number of mining leases by Marlborough Nickel Pty Ltd, a subsidiary of Preston Resources NL for the Marlborough Nickel Project. The Marlborough Nickel Project envisages a proposed production rate of 1 million tonnes per annum with the mine life likely to exceed 20 years. The deposits will be mined using large scale open-cut methods, the mined ore being treated further to provide beneficiated feedstock to the on-site processing plant for milling and extraction of product by using a high temperature acid pressure-leach/solvent extraction/electrowinning technology. The deposits include Slopeaway, Magpie West, Magpie East, Kurrawong, Wattle Hill, Coorumburra West, Coorumburra East, Junction and Surfers. The Slopeaway deposit also has other mining interests held by Gumigil Pty Ltd, Viper Resources Pty Ltd and Australian Jade Exploration Pty Ltd.

At this early stage of development planning, Marlborough Nickel Pty Ltd also holds a number of Exploration Permits for Minerals over these deposits and further tenures including mining leases or mineral development licences may be applied for as plans are further progressed in the future.

The company has indicated that transport access for the mine and processing plant will be to the north along the Coorumburra Road, which connects the Sarina Road (the old highway), and on to the Bruce Highway near Marlborough. A proposed link to the main North Coast Railway and loading facilities at Marlborough is also envisaged.

Gumigil Pty Ltd and Viper Resources Pty Ltd hold deposits of chrysoprase under mining lease. The two existing chrysoprase mines (on Mining Lease No's 5791, 5792, 5802 held by Gumigil Pty Ltd and Mining Lease No's 5780, 80004, 5772, 7577 held by Viper Resources Pty Ltd) are located largely within the Slopeaway lateritic nickel deposit. Other chrysoprase resources held under mining lease, but not yet developed, are also located in the vicinity within other known nickel deposits.

### ***Planning and Environmental Situation***

The resources are situated in steep vegetated ridges and hills of moderate to high relief that form a divide immediately west of Marlborough Creek from Mt Slopeaway south towards the Fitzroy River. It is also part of the largest serpentinite body in Queensland, which has significant flora present. The surrounding land is used for grazing, being part of larger pastoral holdings. There is no prospect of closer settlement in the area.

### ***Recommended Key Resource Area***

The deposits are the basis of the Marlborough Nickel Project, which has State major mineral project status. The proposed project is awaiting project finance. Hence, a Key Resource Area is recommended to recognise these deposits and existing chrysoprase mines to provide protection from potentially conflicting land uses. The KRA is largely within Livingstone Shire, but extends partly into the Fitzroy Shire in the south.

### ***Boundaries of Key Resource Area***

The boundary of the Key Resource Area recommended is 1km from known deposits and current mining tenures.

A possible future haul route is designated from the proposed processing plant site along Coorumburra Road to the Sarina Road linking to the Bruce Highway near Marlborough.

### ***Outcomes Recommended for the Key Resource Area***

- (a) No constraints on rural activities currently permitted by the planning scheme, including new dwellings on existing rural lots;
- (b) Any intensification of *rural* activities which requires development approval for material changes of use, be subject to code or impact assessment to determine whether the proposed use can be carried out without detriment to the mining operation or future access to the resource, and is suitable in itself in such an mining area;
- (c) No intensification of residential, rural residential or small lot rural settlement through reconfiguration of lots or material changes of use;
- (d) Any industrial development, other than that required or associated with the mining operation, be subject to code or impact assessment to determine whether it can be carried out without detriment to the mining operation or future access to the resource; and
- (e) Referral of development applications for (b), (c) and (d) above to the Department of Natural Resources and Mines for third party advice.

### ***Outcomes Recommended for the Haul Route***

- No construction of new residential dwellings within 100m from the road boundary unless it can be demonstrated that they are compatible with the haulage operation or siting within that distance is essential or unavoidable.

## **MOORES – LAGOON HILL NICKEL/COBALT**

### **Potential Key Resource Area shown on Figure 13**

#### ***The Resources***

Extensive lateritic nickel/cobalt deposits occur in the Marlborough area, north-northwest of Rockhampton which were first explored by The Broken Hill Proprietary Company Limited during the period 1964-66. Detailed exploration and testing continued until the early 1970s by the International Nickel Corporation. Subsequently, the deposits were held by a number of companies until Preston Resources NL acquired Lagoon Hill Nickel NL, which had as its major asset, the nickeliferous laterite resource known as the Marlborough Nickel Project.

#### ***Current Status***

The Moores and Lagoon Hill deposits are held under Exploration Permit for Minerals No. 11195 by Marlborough Nickel Pty Ltd, a subsidiary of Preston Resources NL. Whilst detailed exploration has been undertaken on these deposits, their possible future development is still in the early planning stages.

#### ***Planning and Environmental Situation***

The resources are situated in a series of steep hills with moderate to high relief on either side of the Fitzroy River in the vicinity of the junction of Princhester Creek. The surrounding land is used for grazing and there is no immediate likelihood of closer settlement.

#### ***Recommended Key Resource Area***

A Potential Key Resource Area only is recommended here because plans for any possible future exploitation are still in the early stages and applications for mining tenures over these deposits are yet to be made. However, their importance as an integral part of the overall lateritic nickel resource for the proposed Marlborough Nickel Project should be acknowledged.

#### ***Boundaries of Potential Key Resource Area***

The boundary of the PKRA for the protection of the deposits includes a separation distance of 1km from the resource where possible to protect them from any conflicting land use and ensure any future exploitation remains possible there. The PKRA straddles the Fitzroy and Livingstone Shire boundary.

#### ***Outcomes Recommended for the Potential Key Resource Area***

- (a) No constraints on rural activities currently permitted by the planning scheme or on new dwellings on existing lots;
- (b) Because of the long time frames involved, no constraints also on any intensification of *rural* activities requiring development approval for material changes of use;
- (c) Any industrial development, other than associated with future mining, be subject to code or impact assessment to determine whether it can be carried out without detriment to a future mining project or future access to the resource;
- (d) No intensification of residential, rural residential or small lot rural settlement through reconfiguration of lots or material changes of use; and
- (h) Referral of any development applications for (c) and (d) above to the Department of Natural Resources and Mines for third party advice.

## **GLENROY – CRAIGILEE LIMESTONE**

### **Potential Key Resource Areas shown on Figure 14**

#### ***The Resources***

Extensive beds of oolitic limestone in the Early Carboniferous Rockhampton Group have been identified in the Glenroy - Craigilee area (Krosch and Kay, 1977). Significant deposits are located on the western side of the Fitzroy River across from “Craigilee” homestead and about 7km northwest of “Glenroy” homestead. Low to high-grade limestone occurs in low hills in close proximity to the Glenroy - Coorumburra Road. At the Glenroy deposit, some small pits have been worked for road maintenance gravels.

#### ***Current Status***

The Glenroy deposit is held under Exploration Permit for Minerals No’s 13804 (Application) and 12130 by Marlborough Nickel Pty Ltd. The area over the Craigilee deposit is held under Exploration Permit for Minerals No’s 12346 and 12796 by Marlborough Nickel Pty Ltd. It is proposed that limestone from these deposits would be used for acid neutralisation at the nickel processing plant should the Marlborough Nickel Project proceed sometime in the future.

#### ***Planning and Environmental Situation***

The resource is situated in rural land used for grazing purposes and there is no immediate likelihood of closer settlement.

#### ***Recommended Key Resource Area***

Two separate Potential Key Resource Areas are recommended to recognise these deposits as a potential convenient source of limestone for use by the proposed Marlborough Nickel Project and to protect them from conflicting land uses. Both PKRAs are within the Fitzroy Shire.

#### ***Boundaries of Potential Key Resource Areas***

The boundary of both PKRAs is recommended at 1km from the extent of the deposit to provide a suitable separation distance around the resource so it remains available for exploitation in the future if needed.

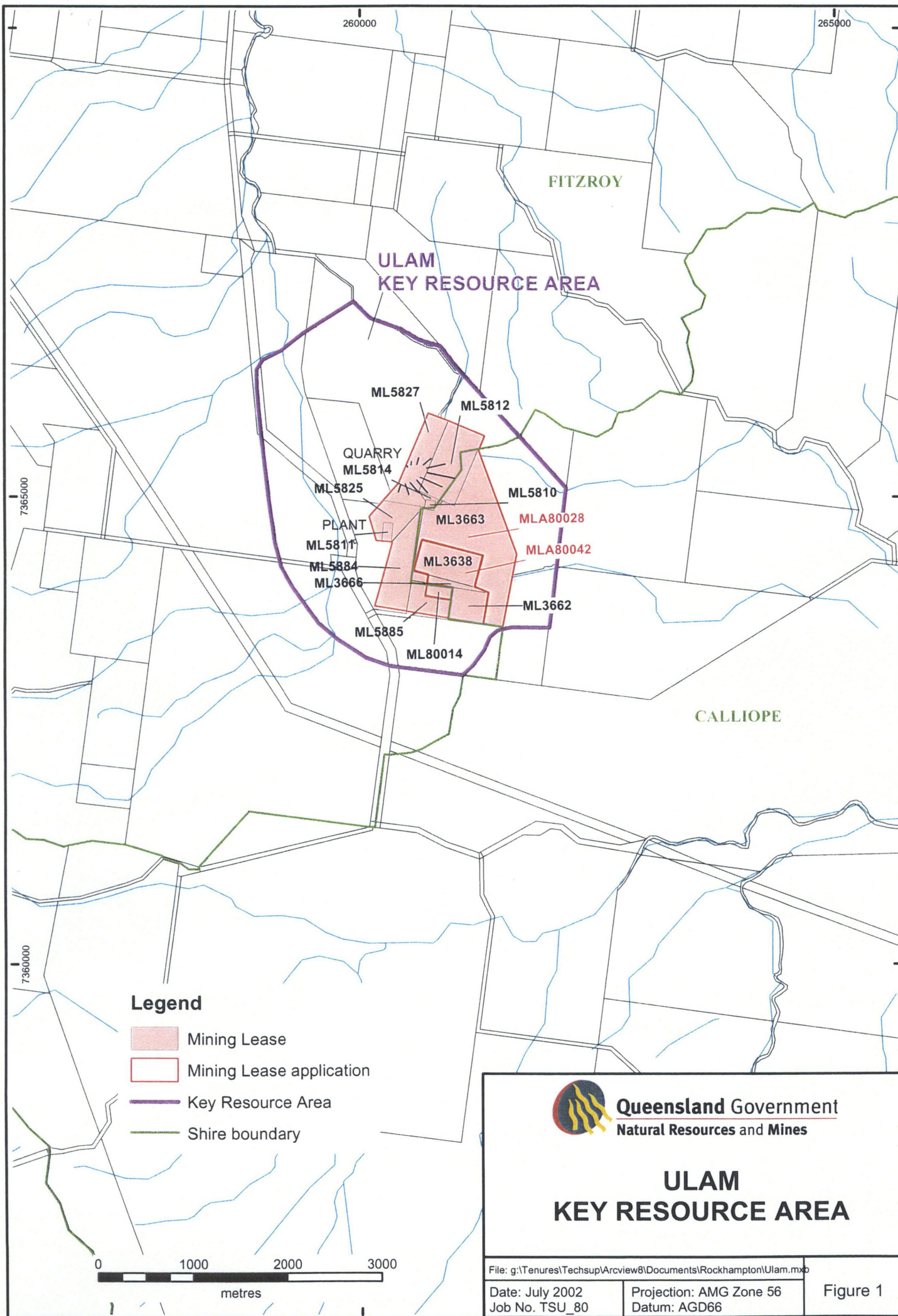
#### ***Outcomes Recommended for the Potential Key Resource Areas***

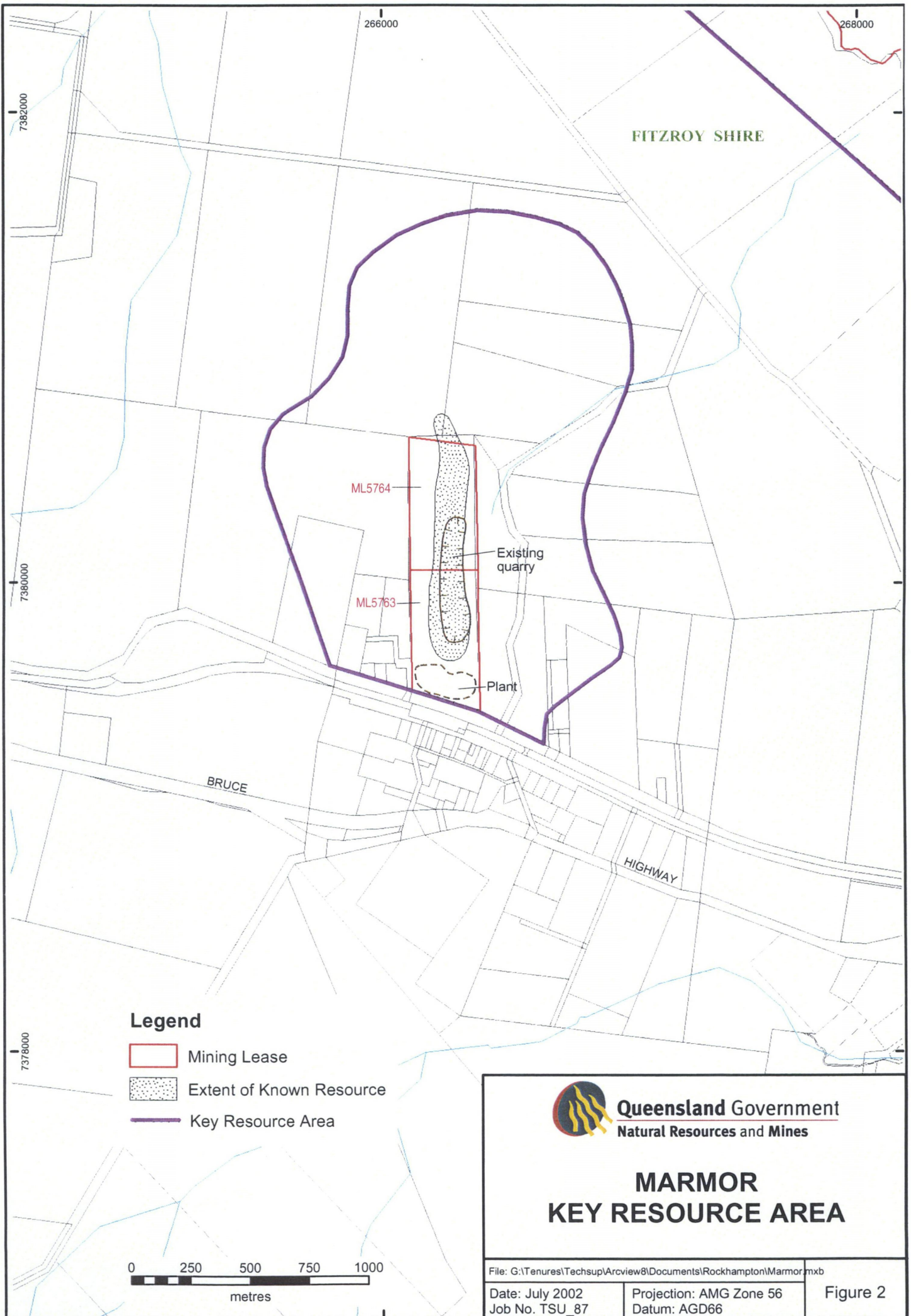
- (a) No constraints on rural activities currently permitted by the planning scheme or on new dwellings on existing lots;
- (b) Because of the long time frames involved, no constraints also on any intensification of *rural* activities requiring development approval for material changes of use;
- (c) Any industrial development, other than associated with future mining, be subject to code or impact assessment to determine whether it can be carried out without detriment to a future mining project or future access to the resource;
- (d) No intensification of residential, rural residential or small lot rural settlement through reconfiguration of lots or material changes of use; and
- (i) Referral of any development applications for (c) and (d) above to the Department of Natural Resources and Mines for third party advice.

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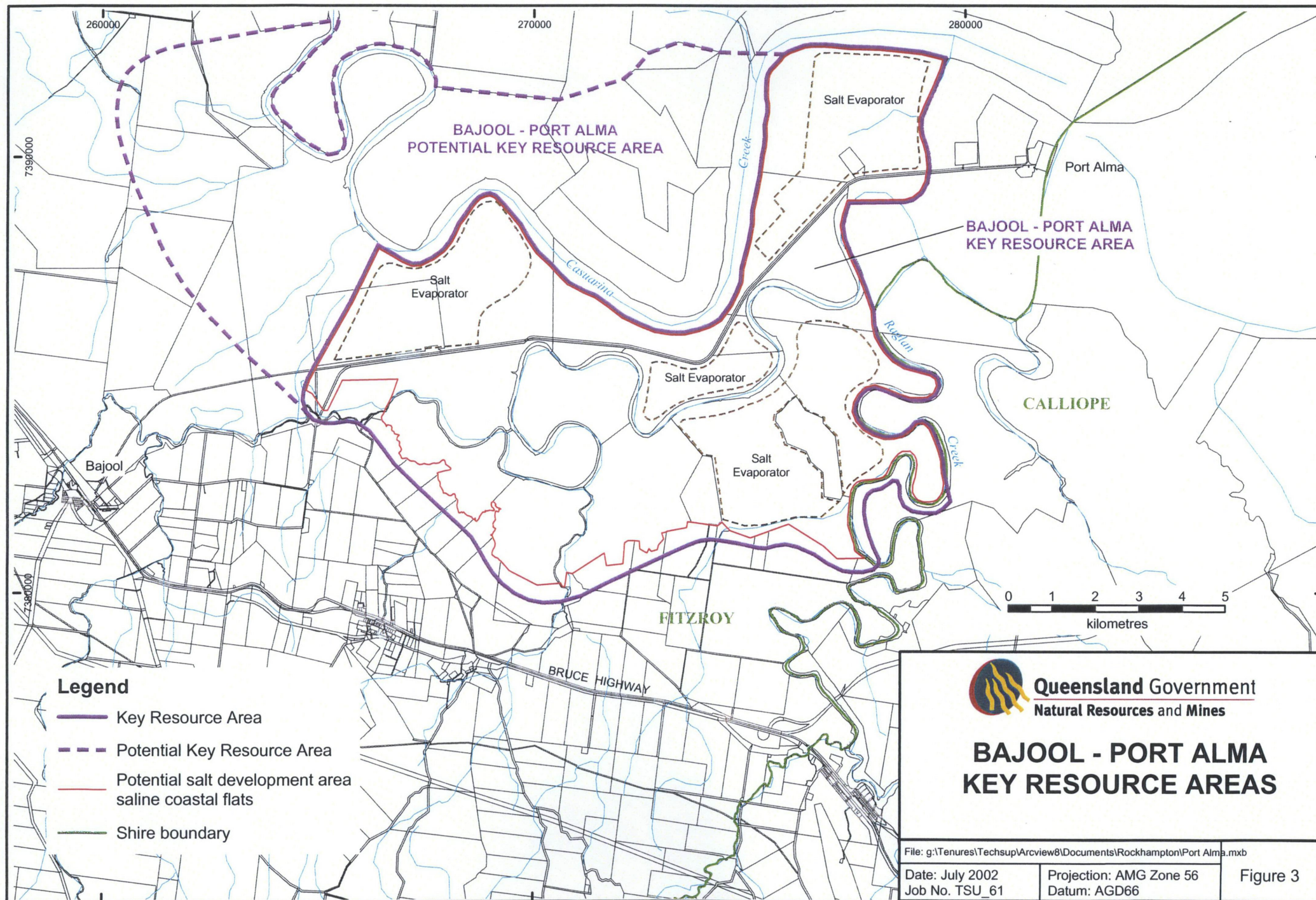
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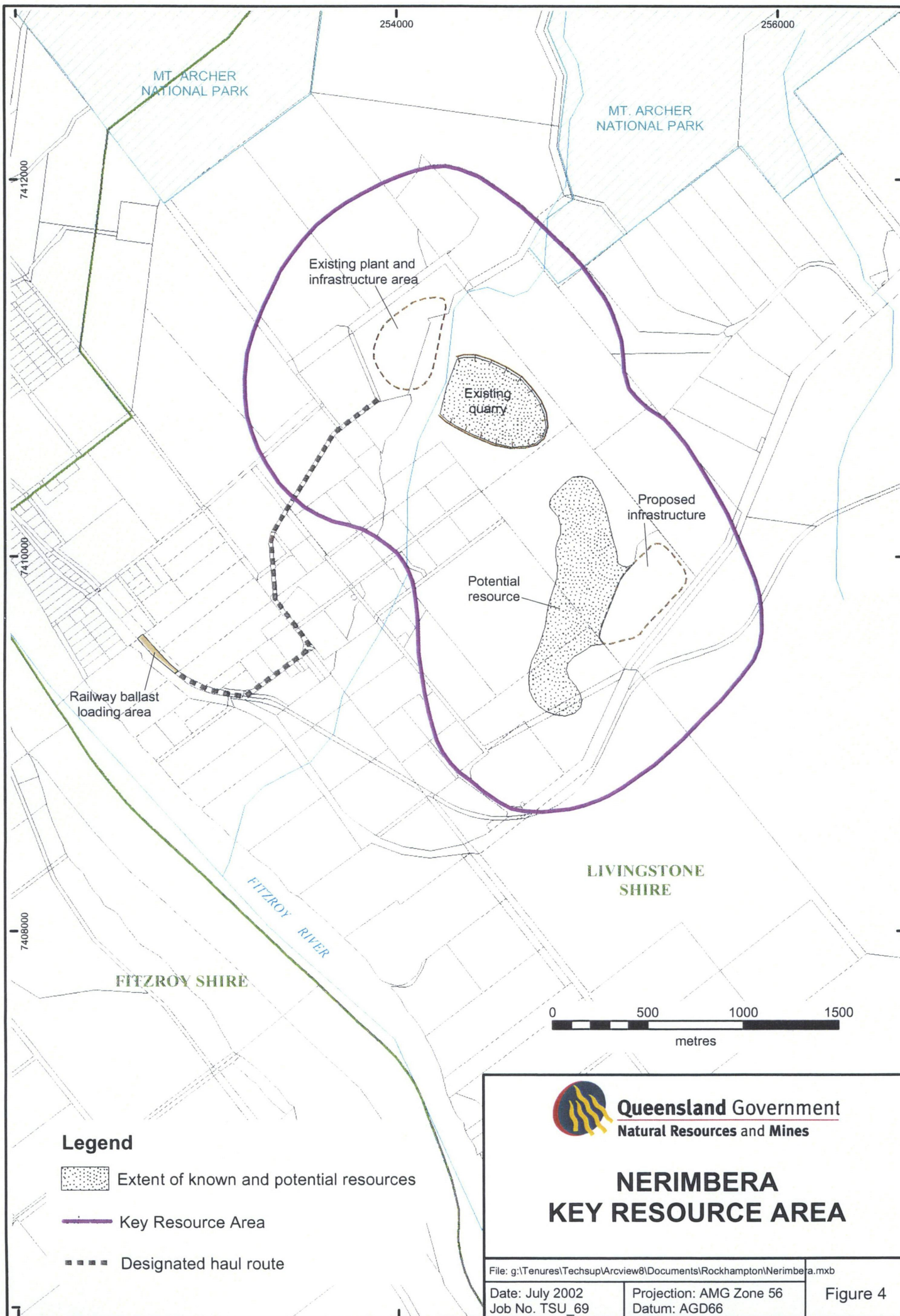




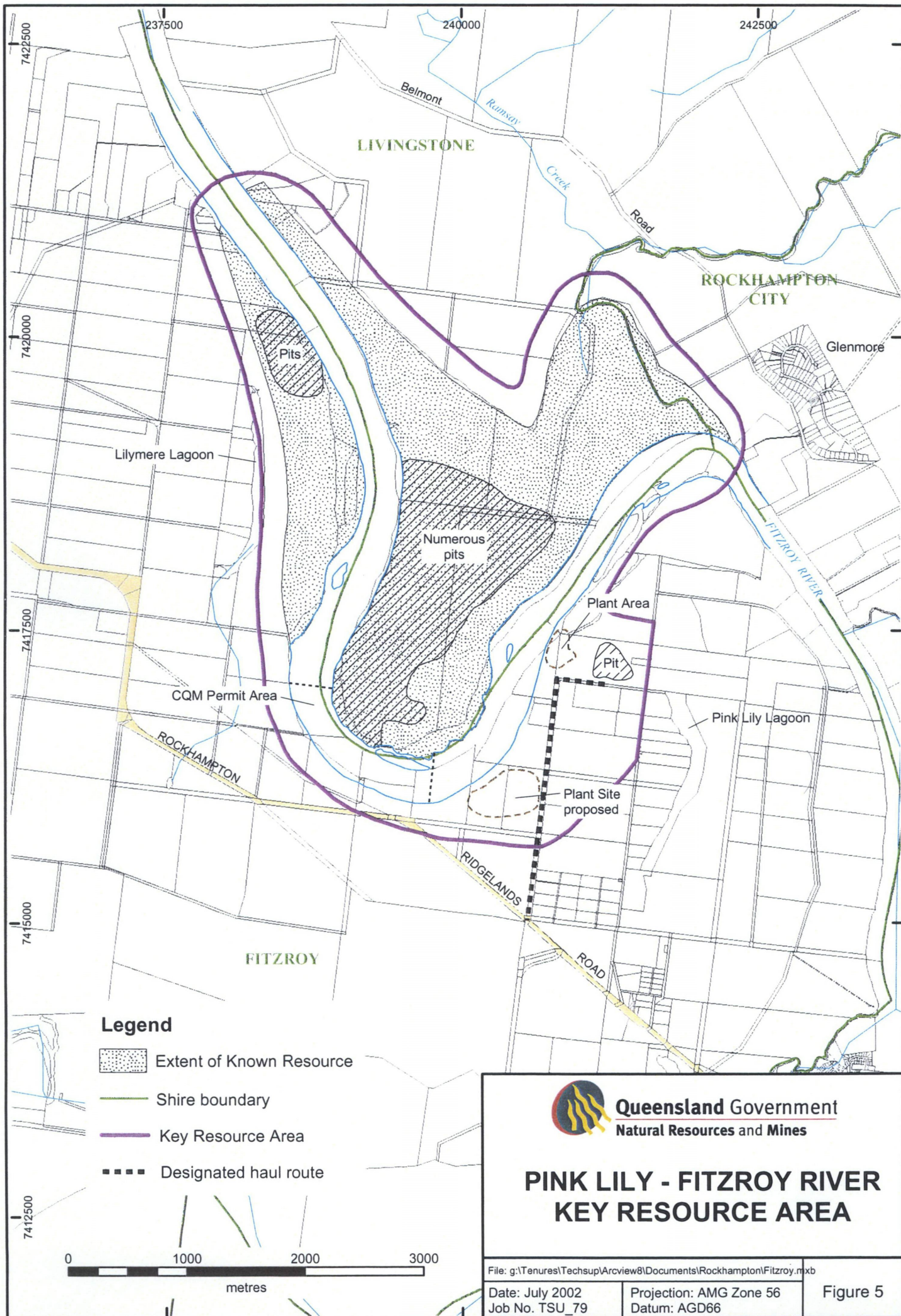




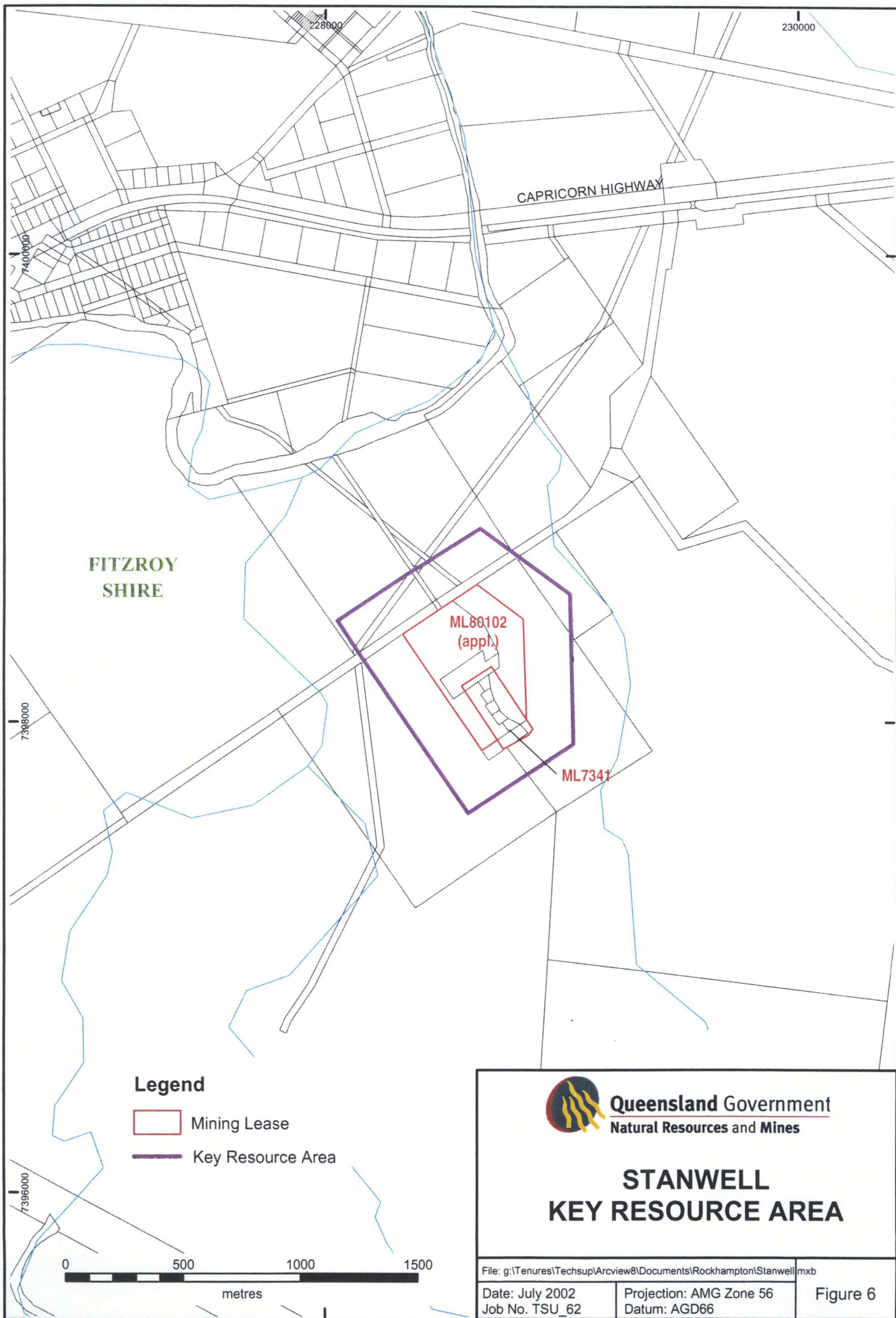
















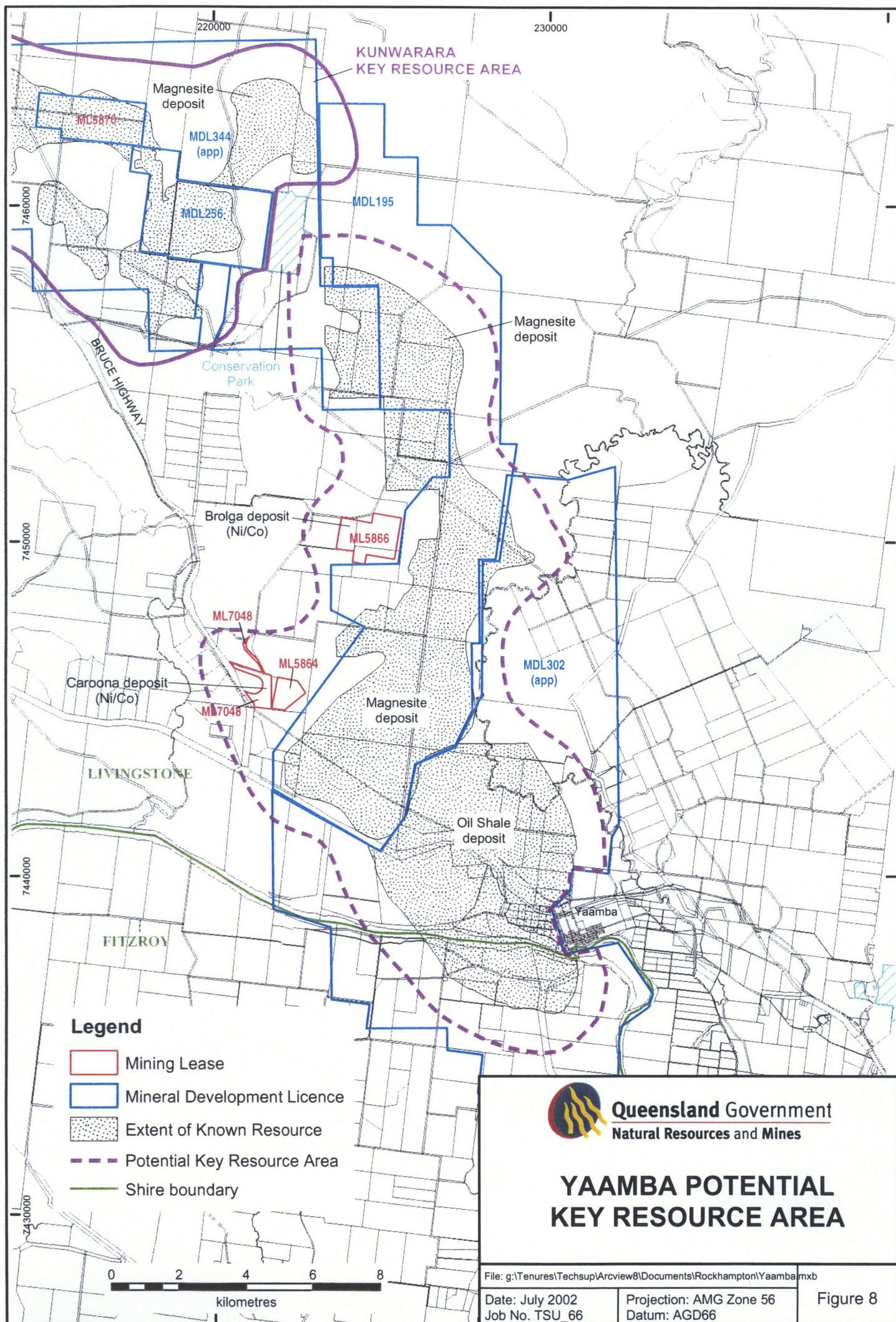
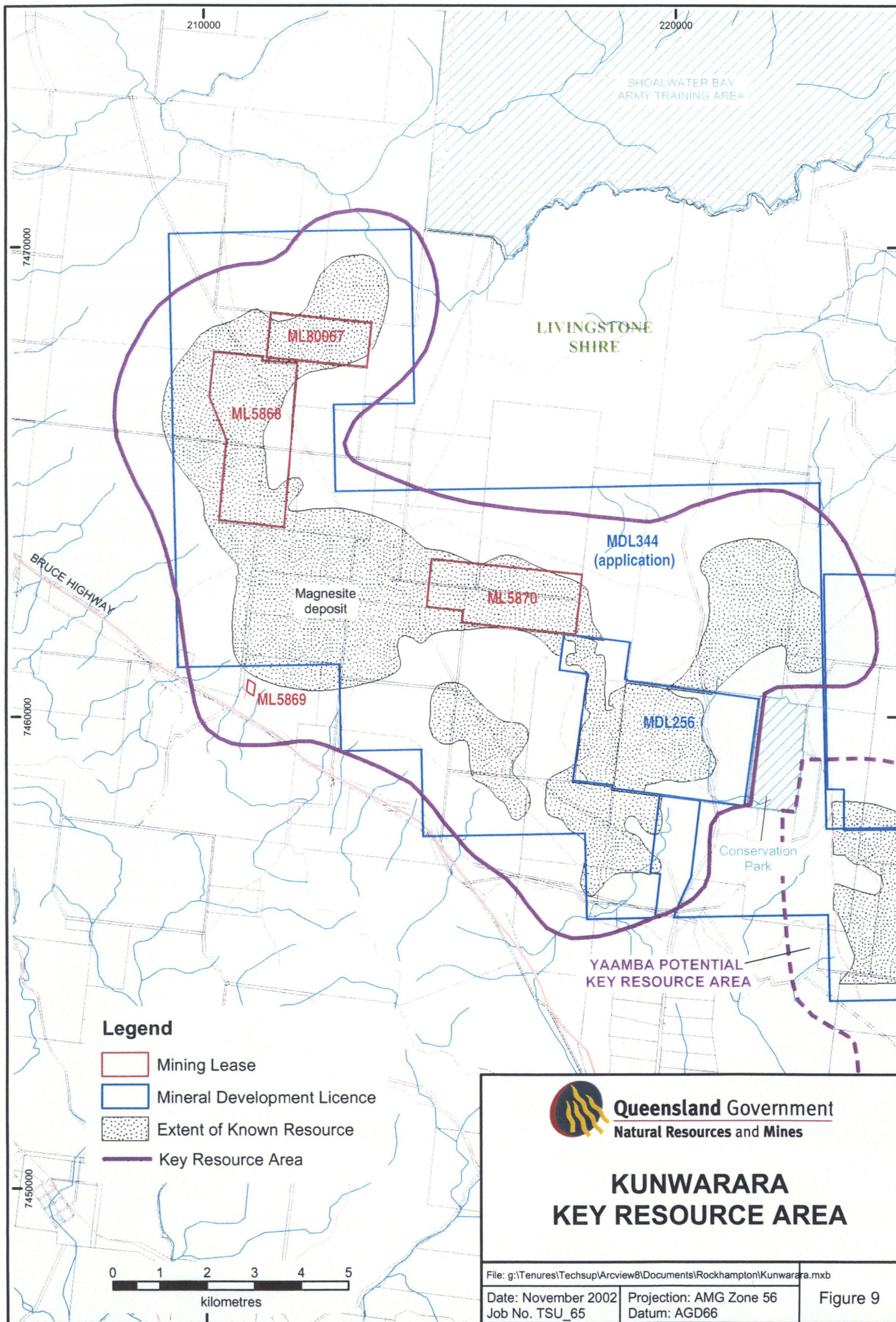



Figure 8







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## KUNWARARA KEY RESOURCE AREA

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Date: November 2002	Projection: AMG Zone 56	Figure 9
Job No. TSU_65	Datum: AGD66	



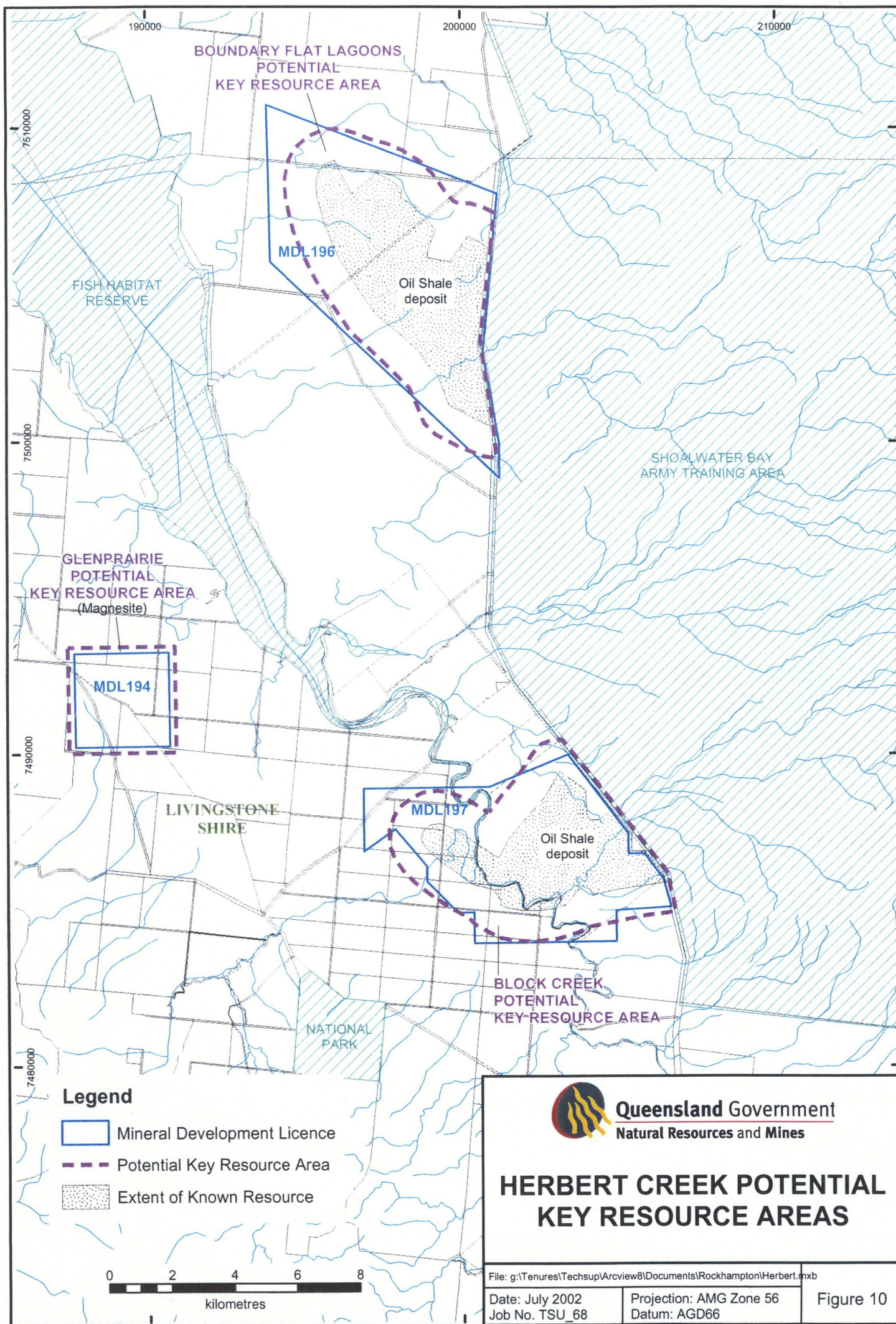
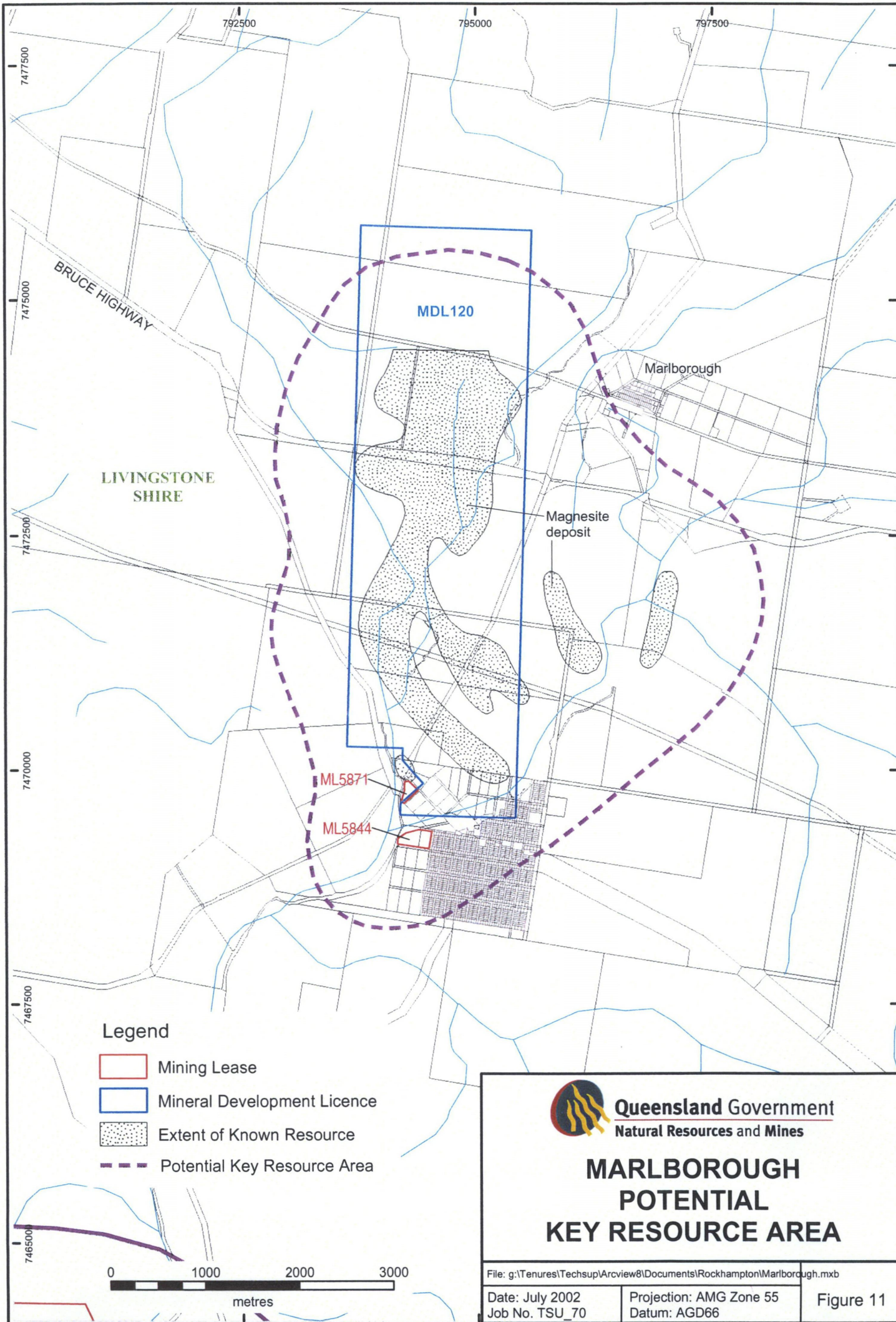


Figure 10









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## MARLBOROUGH (Slopeaway-Coorumburra) KEY RESOURCE AREA

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Date: July 2002  
Job No. TSU\_71

Projection: AMG Zone 55  
Datum: AGD66

Figure 12

### Legend

-  Mining Lease
-  Extent of Known Resource
-  Key Resource Area
-  Shire boundary
-  Designated Haul Route

