Assessment of Constraints to Supply of Extractive Materials in Critical Demand Areas

Queensland flood and cyclone damaged road reconstruction program (TNRP)

MIP 115/11
24th February 2012

■ Quarries ■ Resources ■ Solutions

SITUATIONAL ANALYSIS

In the 2010-11 flood disaster and cyclone-affected regional areas of Queensland, where there is high sustained demand for quarry materials over the next few years (from coal mine, gas and related infrastructure), there are limitations to the quarrying industry's capacity to supply quarry products (roadbases and aggregates) for TNRP and Qld RA road reconstruction works.

These quarry (supply side) constraints include approval and licensing of known extractive resources, existing market commitments, stockpile quantities and space, processing plant capacities, labour shortages (in coal mine/CSG gas development areas) and truck constraints or shortages.

Collectively these constraints have a moderate to high potential to delay the timeframe for completion of TNRP projects in Critical Demand Areas (CDA's), unless remedial solutions to address constraints can be identified and implemented.

CONTENTS

DISCLAIMER

This report provides a broad assessment of TMR's and Qld RA's upcoming demand for quarry materials which may or may not eventuate according to the information in this report and organisations should not rely on this information to inform any business decisions they choose to make.

ASSESSMENT OF CONSTRAINTS TO SUPPLY OF EXTRACTIVE MATERIALS IN CRITICAL DEMAND AREAS

Queensland flood and cyclone-damaged road reconstruction program (TNRP and Qld Reconstruction Authority)

EXECUTIVE SUMMARY

FEB 2012
Ecoroc Pty Ltd

This report provides a summary of the findings of a desktop study, industry consultations and a situational analysis completed over the period December 2011 to February 2012.

A TNRP "All Quarries" database that can be consulted in MapInfo has been developed, with a focus on Queensland's eight (8)most flood-affected regions (referred to as Critical Demand Areas or CDA's). These comprise the DTMR regions of Mackay/Whitsunday, Fitzroy, Central West, North West, Far North, South West, Darling Downs and Wide Bay Burnett.

The "All Quarries" database describes existing and potential hard rock quarry sites. It includes a "point in time" assessment of quarries' capabilities and capacities to supply quarry products to Qld's road reconstruction program. This has been expressed as a theoretical monthly 'discretionary supply' capacity for the 2012-2014 reconstruction period. A worksheet tool has also been developed to assist in ongoing demand ~ supply modelling of quarry materials for road reconstruction planning purposes.

The database identifies a total of 406 hard rock quarries (or potential extractive resources) across Qld, 288 of which are in the eight CDA's. Of these, 80 quarries or (28%) have been characterised as "Strategic Quarries" and 75 (or 26%) as "Quarries of Interest" (155 total). These quarries are expected to provide the 'lion's share' of supply of the Type 2.1 (2.2) roadbase and/or cover aggregates needed for the TNRP and Qld RA road reconstruction effort. Less than 50% of Strategic Quarries have pre-coated aggregate plants and only about 10% have Cement Treated Base (CTB)/pugmill plants.

Only 40% of actual hard rock quarry sites in regional Qld are suitable or able to supply the road reconstruction works. This is mainly because of constraints such as source rock type and technical suitability (geology), but also approvals, licensing restrictions, pre-commitments to supply, product mix, contestability (eg council pits often not suppliers to the wide market), and capital budgeting issues.

These factors are amongst the "modifying factors" for quarries that drive their commercial and triple-bottom line viability. For the CDA's, the extractive resource, labour and plant/equipment supply-side constraints have been identified, analysed and expressed according to this framework.

Key issues for strategic quarries to overcome supply-side constraints and thus increase their discretionary supply to TNRP, Q Trip and Qld RA projects have been identified. The five (5) dominant supply-side constraint factors and their respective influence on discretionary supply are:

MODIFYING FACTOR (CONSTRAINT)	RELATIVE IMPACT
• Market/Customer/Competitive Choice/Scheduling	55%
• Truck Transport	15%
• Processing plant and stockpiling	10%
• Approvals and licensing	8%
• Resource and extraction constraints	8%

Industry has emphatically reported that the most effective initiative to improve discretionary supply capability over the next 2-3 years is to ensure advanced notice of the need for supply roadbase and pre coat aggregates, is communicated to quarries – 3 months has been suggested as a target in significant shortfall areas (eg MWR, FTR, SWR, DDR).

With forewarning, quarries can plan to mitigate some of the other constraints – For example by arranging for mobile crushing plant, adding a second shift, booking cartage contractors, installing a pre-coat plant, undertaking stripping of overburden, opening up a second face, extending stockpile areas (if room available), and recruiting labour.

Initiatives to streamline approvals and licensing, and assist with productivity and risk management, are also necessary if quarries are to respond to the demands of peak production, and comply with licensing and OH&S provisions and obligations.

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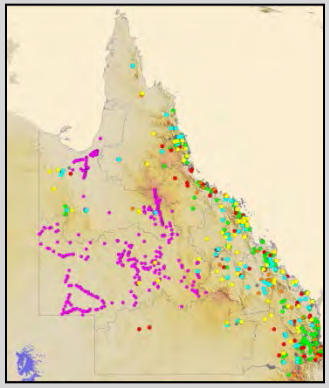


ECOROC PROJECT TEAM

Project Director

Dugald Gray *BE Mining (*Qld), *MBA* (Bond); Quarrying industry consultant, mining engineer with 30 years professional experience in strategic, general and operational management in the quarrying, construction materials and civil infrastructure development industries.

Project Manager

Dr Graham Shorten *PhD* Civ Eng (Sydney), *MSc* (Qld), *BSc* (Qld)
Geoscientist and international geohazards consultant with 40 years experience in risk assessment of infrastructure and resource assets; Particular expertise in geotechnical assessment of quarries and analysis of geoscience data and information using MapInfo.

Database Manager

Ken Granger *BSc* Applied Geography (CCAE), MA (ANU)
Risk Scientist and Applied Geographer with 49 years experience in the capture, analysis and application of spatial information to address issues and solve problems in the public safety, emergency risk management and asset management fields.

Project Officers – Specific Quarry Investigations

Alan Robertson
Principal of quarry/mining engineering consulting firm Ausrocks with 40 years experience in mining, quarrying & tunnelling; Quarry expertise includes operations, resource evaluation, quarry design, material assessment, quarry safety audits and quarry planning.

John Siemon
Principal JE Siemon and Associates – Geoscientist and highly experienced in Qld extractive industry resource and reserves investigation and evaluation.

Carl Morandy
Consulting mining engineer, Ausrocks - Principal quarry researcher and special projects officer for TNRP project.

Mike Cooper
Principal MD Cooper Consulting Pty Ltd – Quarry management, operational and processing plant expert – 30 years industry, management, consulting experience.

John (Bronco) Johnston
Quarrying industry consultant, a 50-year veteran of the industry as co-owner and operator of quarries, senior manager, technical expert, superintendent /supervisor of quarry feasibility studies & developments in Australia and South East Asia.

Mike O'Sullivan
Extractive industry consultant geologist, Principal of Extractive Industry Services Ltd – highly experienced in the Mackay, Isaac, Central Highlands and Bowen Basin regions.

Abbreviations or Terms used in this report

CDA	Critical Demand Area
CTB	Cement Treated Base (small % of cement added to roadbase)
DTMR	(QLD) Department of Transport and Main Roads
ktpa	kilotonnes per annum
LGA	Local Government Area
Mt	Million tonnes
Pre Coat	A sized, crushed rock aggregate coated with a bituminous emulsifier prior to use as a road surfacing aggregate
Qld RA	Queensland Reconstruction Authority
tpa	tonnes per annum
SPA	Sustainable Planning Act 2009
TNRP	Transport Network Reconstruction Program
UPM	Unbound Pavement Material

This report provides a summary of the findings of a study and situational analysis to identify and assess constraints to the supply of quarry materials (crushed rock) in Critical Demand Areas (CDA's) for Queensland's road reconstruction works.

The study has consulted widely with extractive industry and created a TNRP "All Quarries" database for Queensland's eight (8) most critically-affected regions. The database identifies existing or potential hard rock quarry sites by LGA that can/could supply Type 2.1 (2.2) roadbase and/or cover aggregates to TNRP works.

The supply side constraints have been identified and impacts and/or potential supply bottlenecks assessed.

Supply-side constraint issues and suggested remedial measures based on a synthesis of feedback from the quarrying industry and our analyses, are provided to inform policy development.

PROJECT CONTEXT

QUARRY MATERIAL DEMAND FROM ROAD RECONSTRUCTION WORKS 2011-2014

Department of Transport and Main Roads (DTMR) and the Queensland Reconstruction Authority (QldRA) have, across the ten (10) flood and cyclone affected regions of Queensland, estimated the quantity and monthly timing of need for roadbase and coarse aggregate materials for state-controlled and local council road reconstruction projects.

Two quarry material types, Type 2.1 roadbase and cover aggregates, are critical to the road reconstruction program. Total demand forecasts for quarry materials for road reconstruction for the DTMR's Transport Network Reconstruction Program (TNRP) from April 2011 to June 2014 have been estimated by DTMR as:

i. 14 Mt (million tonnes) of roadbase materials (sometimes referred to generically as 'gravel')and

ii. 1.5 Mt of aggregate (cover aggregate for road surfacing).

In addition to TNRP demand, Qld RA has estimated demand from local government road reconstruction works across the state at approximately 11.3 Mt (of roadbase materials and aggregates) over the period from November 2011 to June 2014.

The projected quarry material quantities by DTMR region are summarised in Table 1 for the eight (8) most affected regions according to total demand for quarry materials for road reconstruction works. About 85% is roadbase (all types) and 15% is cover aggregate.

TABLE 1: FORECAST TOTAL DEMAND FOR HARD ROCK QUARRY PRODUCTS IN CDA'S – QLD ROAD RECONSTRUCTION WORKS 2011-2014

Rank	DTMR region	Total TNRP Demand (Mt)	Qld RA Demand (Mt)	Total Demand TNRP + Qld RA (Mt)
1	Fitzroy	4.30	1.03	5.33
2	Central West	2.60	1.71	4.31
3	Far North	1.90	1.72	3.62
4	Southwest	2.00	0.92	2.92
5	Mackay/Whitsunday	1.70	0.97	2.67
6	Northwest	1.60	1.25	2.85
7	Darling Downs	0.57	1.27	1.84
8	Wide Bay/Burnett	0.46	0.54	1.00
9	North Coast	0.18	0.16	0.34
10	Metropolitan	0.11	0.86	0.97
11	Northern	0.06	0.69	0.75
12	South Coast	0.02	0.13	0.15
	Total	15.5	11.3	26.8

Source: DTMR, Qld RA Dec 2011

SUPPLY SIDE CONSTRAINTS FOR ROADBASE AND AGGREGATES IN CRITICAL DEMAND AREAS

Supply constraints have moderate to high potential to impact on the timeframe for completion and cost escalation of TNRP and Qld RA road reconstruction works in Critical Demand Areas.

The risks are especially high in regions where there is coincident and ongoing demand from major projects (eg port, rail, mining, gas related infrastructure). Quarries in these areas have finite resources and a discretionary supply capability. To overcome potential shortfalls in the rate of supply to TNRP projects, either existing quarries need to be encouraged to produce more (and) or new extractive resources need to be brought quickly into production. The latter is by no means easy – it can take several years for a new quarry to be approved under planning law (SPA).

This report consists of three (3) main sections:

A. Supply Side Analysis
Update of 'All Quarries' DTMR quarry (hard rock resource) database in the eight (8) CDA's to improve veracity of hard rock quarry material source information, quarry locations & supply capabilities to TNRP projects;

B. Demand Side Analysis

Overview of projected demand for quarry materials from TNRP (state road reconstruction) works and other projects over the period 2012 to 2014; and

C. Supply Side Constraints Analysis for CDA's and Remedial Suggestions

Assessment of demand ~ supply imbalances in CDA's; Strategic Quarries and Quarries of Interest; Appraisal and evaluation of discretionary supply and constraints to supply; Recommendations to address or overcome constraints.

PROJECT DELIVERABLES

For the eight (8) regions of highest quarry material demand for the TNRP:

1. Create an updated "All Queensland" quarries database – include identification and mapping using geospatial co-ordinates of existing quarries / extractive resources including quarry name, operating status, source rock type, annual output, product types, approved products to DTMR, quarry description, and discretionary capacity to supply TNRP project work from 2012 to 2014;

2. Compile and review demand data for TNRP, Qld RA and Q-Trip; Review effects of major projects including port, rail, mine and gas projects in the Mackay/Whitsunday, Fitzroy, Central West and South West regions;

3. Identify potential shortfalls between demand and supply in CDA's and identify 'Strategic Quarries ' to the TNRP and 'Quarries of Interest', 'Strategic Quarries' are expected be crucial for the supply of Type 2.1 roadbase and/or cover aggregates for TNRP and Qld RA works – 'Quarries of Interest' may be able to supply.

4. Advise on industry constraints / supply bottlenecks and provide recommendations for actions to overcome constraints in CDA's; and if relevant advise on strategies to enable access to additional (potential) extractive resources to ensure the reconstruction timeframe is not constrained by supply shortfalls.

Shepton Quarry, Capella, Basalt, Fitzroy region – A 'STRATEGIC QUARRY'

Broadlea Coal Mine near Moranbah – fresh basalt overburden – A 'QUARRY of INTEREST'

The project team spent 450 hrs contacting and interviewing quarry industry players across Qld.

Consultations were conducted largely by telephone, with only limited face to face interviews because of time, holiday period and weather constraints.

The TNRP All Quarries database was then compiled using 330 project team hours.

Demand v supply shortfall analyses for CDA's, identification and evaluation of supply-side constraints, and reporting of findings and recommendations required 370 project team hrs.

STUDY APPROACH

For the eight (8) targeted CDA's, undertake a Dec 11 /Jan 12 survey of hard rock quarries and potential extractive resources, across Regional Queensland, using primary and secondary market research techniques including both quantitative and qualitative data.

CONSULTATIONS

1. QUARRYING COMPANIES

Across the spectrum of size and ownership including quarrying firms that own, produce and sell quarry products eg multi-national, national, privately-owned, council controlled and leasehold. Consultations with individual quarries, sales managers, quarry managers, regional managers, general managers, managing directors.

2. CONTRACT CRUSHING FIRMS

Contract crushing firms that undertake 'campaign' or project-specific contract crushing for others including quarries, mines, major projects.

3. GOVERNMENT

- DTMR regions incl. project managers
- DEEDI Mineral & Extractive Planning Unit – Annual reported Quarry Production data
- DEEDI NRW Forest Products – Largest quarry land owner in Qld
- DEEDI Mines Inspectorate – Risk management, OH&S perspectives
- Local Government (Councils)

4. SUPPLIERS, INDUSTRY ORGANISATIONS, CONSULTANTS

Explosives suppliers, plant/equipment suppliers, Cement, Concrete and Aggregates Australia (CCAA), Institute of Quarrying Australia (IQA), Industry geologists/geoscientists, Quarry consultants/engineers.

QUANTITATIVE INFORMATION COLLATED

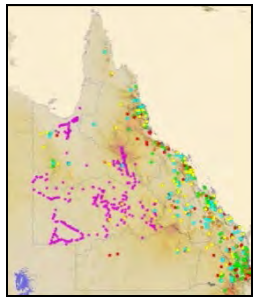
Refer TNRP All Quarries Metadata (Table 3, page 11), showing for example: Quarry type, activity status, name, source rock, production/sales levels, product types, Accredited DTMR supplier status, 'Strategic' or 'Quarry of Interest' Status, Pre-coat plant, CTB/pugmill plant.

Estimate of Monthly discretionary supply for Type 2.1 (2.2) Unbound Pavement Material and Cover (pre-coated cover aggregates).

QUALITATIVE INFORMATION COLLATED

Includes a description of supply-side constraints or bottlenecks; Reasons given by quarries/ contract crushers for being able/not being able to supply TNRP projects; Reasons for not wanting to increase discretionary supply – eg too hard to get DA amended; short notice and over runs puts everything else under pressure; extra technical, financial risks, additional capital requirements); List and Contact Details for Contract Crushing and Screening Firms and quarry drilling companies (Percussion drilling).

Receive, compile, analyse suggestions (from quarrying industry, suppliers and industry analysts/consultants) on ways to address or overcome constraints to maximising the discretionary supply from quarries of Type 2.1 roadbase and cover aggregates to TNRP and Qld RA road reconstruction works.



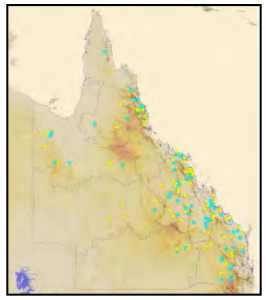


Figure 1 has been adapted from the Mineral Industry's "JORC" Code and shows the relationship between an extractive resource and an extractive reserve of quarryable material.

A reserve has been proven to be commercially viable to extract. It has been evaluated by considering the impact and combined effects of the "modifying factors" on commercial performance.

The "Modifying Factors" determine the commercial viability for a quarry. Because it provides a 'quarry-centric view', the factors provide a useful assessment framework for evaluating quarries and extractive resources.

Ecoroc has adapted the framework to produce a Quarry Assessment Framework or EROC (Extractive Resource Opportunities and Constraints) matrix (refer Figure 2).

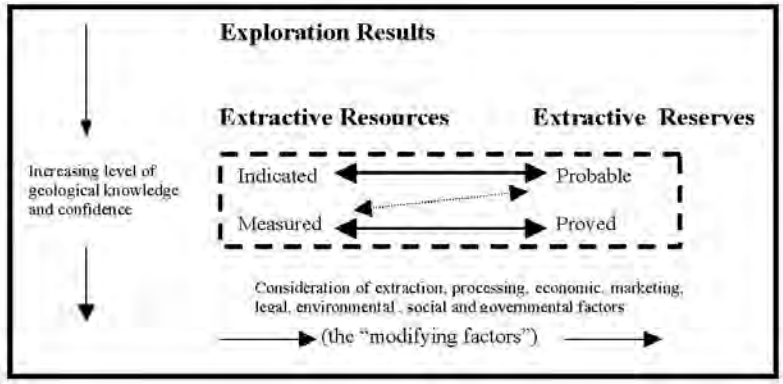


FIGURE 1: RELATIONSHIP BETWEEN EXTRACTIVE RESOURCES AND EXTRACTIVE RESERVES (adapted from the Minerals Industry JORC Code, 2004)

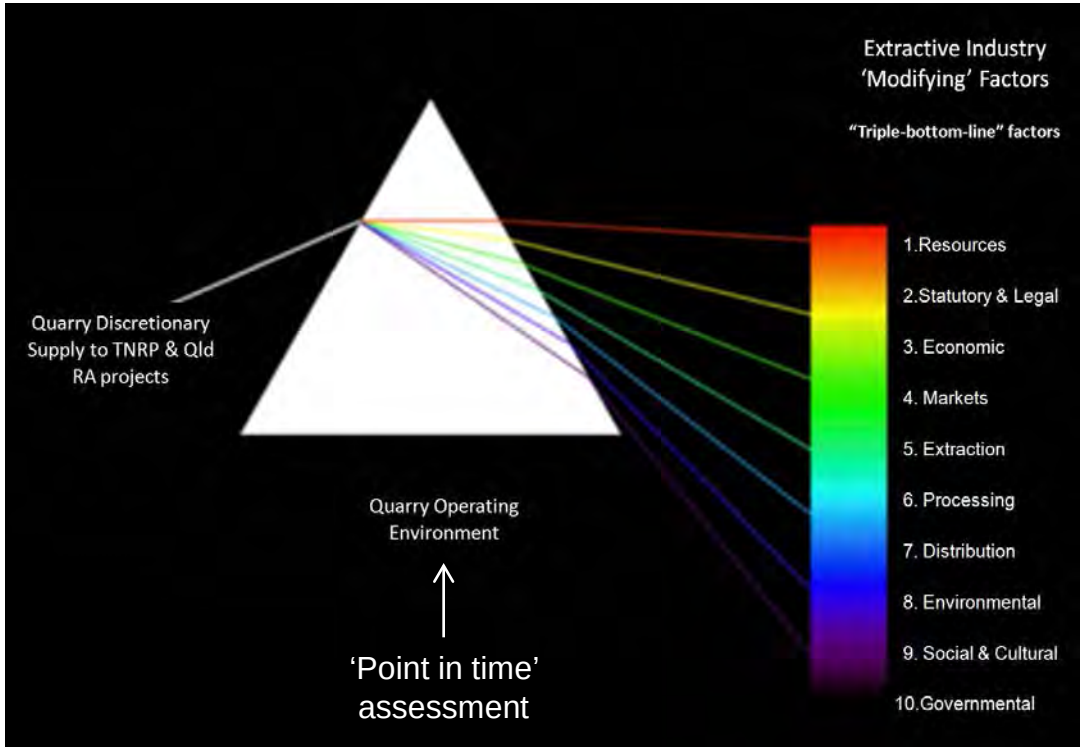


FIGURE 2: QUARRY ASSESSMENT FRAMEWORK – DISCRETIONARY SUPPLY CAPABILITIES TO TNRP

ASSESSMENT FRAMEWORK FOR CONSTRAINTS STUDY

The "Modifying Factors" represent an industry-centric triple bottom line framework and they determine the commercial viability for a quarry or extractive resource.

They therefore provide a useful guide and risk assessment framework for extractive resource/quarry evaluation, including identifying constraints to the discretionary supply from quarries in Critical Demand Areas.

SUPPLY-SIDE CONSTRAINTS ANALYSIS

Supply-side shortages for quarries have been identified as having materials, labour and plant/equipment dimensions.

TABLE 2 indicates these factors of production and provides a summary description of the constraints, undertaken as part of the study.

The constraints are expressed against the 'modifying factors' for quarries, which helps visualise issues, provides an understanding of the inter-relationship between factors and helps in the identification of remedial solutions to mitigate the effects of supply-side impacts.

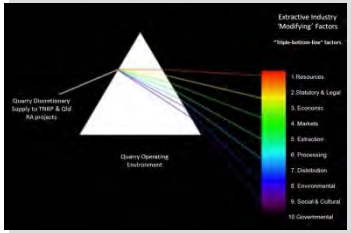


TABLE 2: CONSTRAINT (RISK) FACTORS

1. GEOLOGICAL, EXTRACTIVE RESOURCE FACTORS
Reserves not particularly well-known; Industry has a low degree of exploration expenditure; DTMR specs -variability of source rock quality eg SMC; Efficacy of empirical tests and influence on specs.; Gradings; Poor sampling/testing knowledge in CDA's.

2. APPROVALS, REGULATORY AND COMPLIANCE FACTORS
Time & cost for DA's; DERM ERA thresholds – MCU and impact assessable triggers under IDAS/SPA; DA's for accommodation camps; Approval to use mine owned roads and sell quarry materials from mine sites; Extended hours of operation; Traffic restrictions; Access road/entrance infrastructure requirements; Native title requirements and exemptions; Wild Rivers declaration (Coopers Creek) impact on gravel (borrow) pits in Western Qld.

3. ECONOMIC FACTORS
Demand from major projects in CDA's – eg coal mines, CS gas and related pipeline, rail and port infrastructure; QldRA LGA road reconstruction program; Labour (skills) shortages; Building & construction activity; Local economic conditions; (eg tourism downturn).

4. MARKET FACTORS
Existing customers; Lack of notice of DTMR work; Long term v short term customers; Risk v Return in determining product (sales) mix; Degree of competition and competitive strategy, Degree of contestability in the market to produce Type 2.1 roadbase and cover aggregates.

5. EXTRACTION and SITE INFRASTRUCTURE FACTORS
O/B or stripping ratio; Legacy sites requiring re-development; Poor pit planning (eg campaign sites)- DEEDI OH&S requirement for a Quarry Development Plan; Blast logistics.

6. PROCESSING / MANUFACTURING FACTORS
Reliance on mobile plant & campaign crushing (cf fixed plant); Capabilities of contract crushing firms (labour; skills; expertise); Less than 50% of key quarries have pre-coat plants and only 10% have CTB/pugmill plants.

7. HAULAGE AND DISTRIBUTION FACTORS
Insufficient truck availability during peak demand; Reduce with production and delivery in advance of projects; Cartage price increase during term of supply contracts; Access for road trains; Haulage restrictions (eg Koumala Range); Driver experience / driver fatigue.

8. ENVIRONMENTAL FACTORS
Eg. Air, water, noise, blast (vibration) emissions, water quality impacts, remnant vegetation, site rehabilitation.

9. SOCIAL FACTORS eg. Community opinion (amenity, external impacts, land values etc); Cultural heritage.

10. OTHER Eg. Government attitude; Weather and seasonal effects; Royalty increases; Commercial performance of contract crushing operators.

An 'All quarries' TNRP (hard rock) database has been created by merging DTMR's "All Quarries" database with DEEDI's Quarry Production database (which lists quarries that have reported production in recent years).

The original DTMR 'All Quarries' database listed 332 quarries across Qld. with either an active, inactive or potential status.

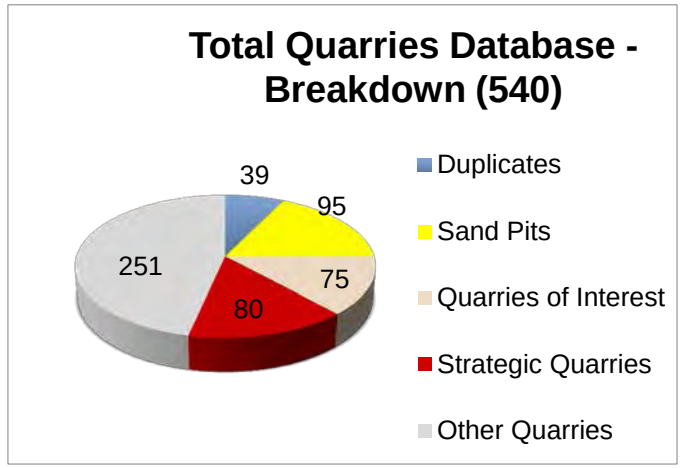
Following desktop review and ground-truthing as necessary, it was found an overlap of 121 quarries existed between these 2 databases.

Furthermore, an additional 16 new hard rock sites or resources were identified as a result of market intelligence and consultations with industry.

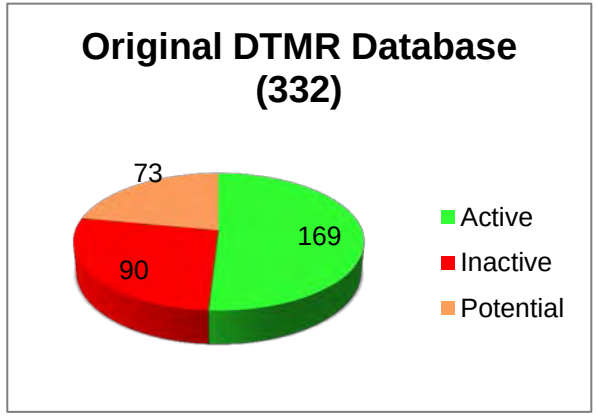
The net result is that the study has identified 406 hard rock quarry sites across Queensland that can (or will be able to) produce crushed rock products.

(i.e. Total Quarries (540) less sand pits (95) less duplicates (39) = 406).

Refer slide overleaf for reconciliation



Note: The sand pit data is that provided in the DTMR database, and has not been updated as part of the TNRP project.



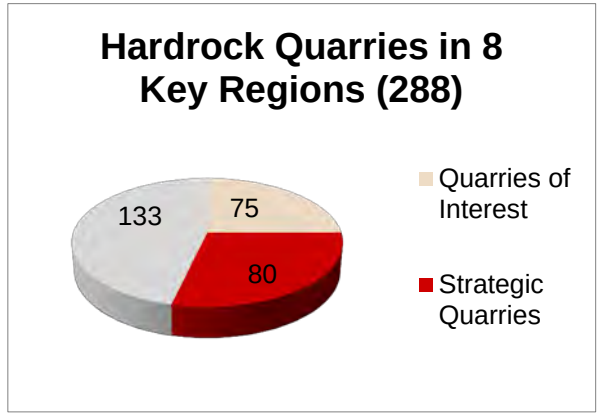


FIGURE 3: HARD ROCK QUARRIES DATABASE - SEGMENTATION

QUARRIES OF INTEREST AND STRATEGIC QUARRIES

Of the 406 hard rock quarries on the TNRP All Quarries database, 288 or 71% are located in the eight (8) regions of interest, which are the focus of this study. Of these 288 sites, 80 have been identified as 'Strategic Quarries' for the TNRP; an additional 75 quarries are 'Quarries of Interest'; 48% of Strategic Quarries have pre-coat plants and about 10% have CTB/pugmill plants.

The 'origin' of the hard rock quarry sites in the updated Qld All Quarries database, is shown in **FIGURE 4: HARD ROCK QUARRIES – ORIGINS.**

One of the principal differences between the DEEDI Quarry Production database and DTMR Quarries database is that the DEEDI database includes local government gravel pits, many of which usually supply local government (internal) needs only.

Note that 16 'new' quarry sites have been added to the revised database.

These new quarry sites are either:

i) Soon to commence production;

ii) Have a development application in progress/pending; or

iii) They represent known sites that have been developed to supply critical infrastructure (eg dams, railway, coal mines etc) and there are good prospects that they could be 'activated' to supply TNRP works, if required.

Not all of the 'new' quarries are 'Quarries of Interest' or 'Strategic Quarries'.

NOTES ON 'NEW' QUARRY SITES

A total of sixteen (16) 'new' sites have been added to the database. These sites have been suggested either by industry or by study team members.

Those sites where the location of the quarry or quarry site is known (or approximately known) have been included in the 16 'new' quarries.

Most of the 16 'new' identified quarry sites do not yet have development approval but are in the process of applying to receive lease approval/development consent.

They occur across all of the CDA's eg FNR, NWR, FTR, MWR, SWR and DDR.

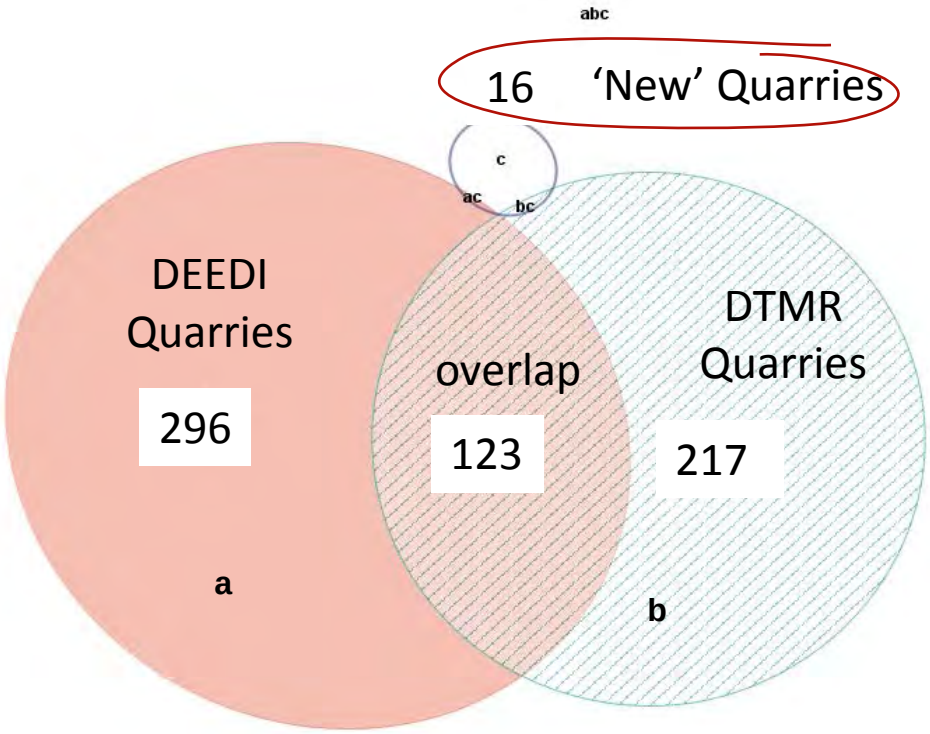


FIGURE 4: QLD HARD ROCK QUARRIES (406 in no.) - ORIGINS

DIFFICULTY IN GAINING APPROVAL FOR A NEW QUARRY

For quarry development applications under SPA 2009, in coastal regions it can typically take 3 years and at least $0.5M in EIS and application costs, to gain approval, assuming there is no challenge to an approval decision. Many quarry development approvals (even extensions) are challenged in some form in the courts. It is therefore simply impractical to expect that 'greenfield' quarry sites could be approved and brought into production within the 2014 timeframe of the TNRP, unless the applications are already advanced and critical tenure issues in regional Queensland such as native title have been properly addressed. For these reasons, in assessing potential or 'new' extractive resources the study has focussed on 'brownfield' sites or prospective quarry sites already under investigation or 'activation' by the marketplace.

TNRP ALL QUARRIES DATABASE – METADATA

The fields of information contained in the TNRP All Quarries database are shown in Table 3.

In addition to the 'standard' quarry details and information, additional fields have been added based on information contained in the DEEDI Quarry Production Database.

The (yellow) highlighted fields at the bottom of the metadata list relate to specific information on the discretionary supply capacity of quarries to service TNRP projects in addition to their existing customers and commitments.

<u>These discretionary supply estimates are highly-conditional and must be reviewed regularly, if they are to have any meaning or utility.</u>

The capability to produce pre-coated aggregates and CTB is also recorded along with notes from research and discussions with the quarry.

TNRP ALL QUARRIES METADATA

The 'standard' fields include quarry status, quarry name, location, operator details, geology, source rock, and approved product types. New fields have been added which address annual production (H,M,L) where known, and product availability by product type.

DISCRETIONARY SUPPLY TO TNRP

These fields are specific to the TNRP quarry supply assessment – the fields are used to record indications/capabilities for (conditional) discretionary supply & precoat and CTB capabilities

TABLE 3: TNRP ALL QUARRIES DATABASE – METADATA

FIELD NAME	DATA TYPE	EXPLANATION
TNRP_ID	Small integer	Unique identifier for the TNRP All Quarries database
Current_Status	Character 9	Assessment of current operational status for TNRP
Hardrock_Sand	Character 9	Products derived from either hard rock or sand deposits
DTMR_Activity	Character 10	DTMR assessment of quarry activity: active, inactive or potential
DEEDI_Status	Character 11	DEEDI assessment of status: operating, approved, suspended, application
DTMR_ID	Small integer	Unique quarry ID assigned by DTMR in order of activity
DEEDI_ID	Small integer	Unique quarry ID assigned by DEEDI
Duplicates	Character 9	Assigned assessment of duplicate quarry for TNRP
Current_Name	Character 36	Assigned name for quarry based on DTMR and DEEDI names & field data
DTMR_Quarry_Name	Character 30	DTMR assigned name for quarry
DEEDI_Quarry_Name	Character 30	DEEDI assigned name for quarry
Operator	Character 30	Quarry operator according to DEEDI and field observation for TNRP
Region	Character 17	DTMR region in which the quarry is located
Lat	Float	Latitude in digital degrees (GDA94 datum) of quarry location
Long	Float	Longitude in digital degree (GDA94 datum) of quarry location
Local_Government	Character 30	Local government area in which quarry is located
DTRM_Source_Rock	Character 40	DTMR assessment of rock type exploited in quarry
DEEDI_Rock_Type	Character 30	DEEDI assessment of rock type exploited in quarry
Lith_Description	Character 254	Lithology at quarry site derived from GA mapping
Unit_Symbol	Character 6	Unit symbol of geological unit from GA mapping
Unit_Name	Character 30	Name of geological unit at quarry from GA mapping
Expiry_Date	Character 10	Quarry license expiry date from DTMR data
DEEDI_Production_Rate	Character 8	Quarry production rate assigned by DEEDI: high, medium, low
Notes	Character 60	Notes on location and activity from Google Earth imagery
Map_100K	Character 8	National 1:100,000 scale map sheet on which quarry is located
DTMR_Nom_Products	Character 200	DTMR listing of quarry products available
DEEDI_Products	Character 80	DEEDI listing of quarry products available
ConcreteAgg	Character 1	Availability of concrete aggregate products (True of False)
CoverAgg	Character 1	Availability of cover aggregate products (True or False)
RailBallast	Character 1	Availability of rail ballast products (True or False)
eq_greatT2_1UPM	Character 1	Availability of Type 2.1 UPM or superior (True or False)
lessT2_1UPM	Character 1	Availability of roadbase inferior to Type 2.1 UPM (True or False)
FineAgg	Character 1	Availability of fine aggregate products (True or False)
Riprap	Character 1	Availability of riprap products (True or False)
Other	Character 1	Availability of other products (True or False)
Quarry of Interest_TNRP	Character 1	Quarry identified as being of interest to TNRP (True or False)
Strategic_for_TNRP	Character 1	Quarry of priority interest and strategic value to TNRP (True or False)
T2_1andT2_2_DiscrSupply	Float	Discretionary production rate of Type 2.1 and Type 2.2 UPM combined (tpm)
Cover Agg_Discr Supply	Float	Discretionary production rate of Cover Aggregate (tpm)
Pre Coat_Facility	Character 1	Presence of a pre-coating facility (True or False)
CTB_Pugmill_Facility	Character 1	Presence of a cement-treated base/pugmill facility (True or False)
Notes_Discr Supply	Character 181	Field notes relating to discretionary supply

A critical outcome for the study has been to identify from the TNRP All Quarries database those quarries which can supply or are already supplying TNRP project work, and those quarries (or resources) which have the potential to supply Type 2.1 (2.2) and /or cover aggregates.

These 'strategic quarries' and 'quarries of interest' are crucial to the flood reconstruction works.

Because they operate under various influences of existing or foreseeable supply constraints and business pressures and strategies, they vary in their capacities to provide discretionary supply to TNRP and Qld RA works.

Nevertheless, the quarries themselves have indicated that the most significant difficulty they face is inadequate notice of the timing to supply Main Roads projects.

These and other supply side issues and/or constraints along with suggestions to address them, are summarised in TABLE 2 (page 8) and discussed in the final section of this report.

STRATEGIC QUARRIES AND QUARRIES OF INTEREST

Strategic Quarries in most instances are established hard rock quarries with a record of supply of roadbase and /or cover aggregate (or equivalent materials) and which have indicated (or it can be reasonably inferred there is) a preparedness to supply TNRP projects with Type 2.1 (2.2) roadbase and/or cover aggregate materials. Note that of the 80 Strategic Quarries, only 38 or 48% indicated they have pre-coating facilities.

There are important conditions or constraints to supply from Strategic Quarries which need to be overcome, but Strategic Quarries represent those quarry sites which are expected to supply the 'lion's share' of TNRP quarry materials over the 2011 to 2014 reconstruction period.

'Quarries of Interest' are candidate sites drawn from the 'TNRP All Quarries' database where discretionary capacity is less well-known, but there is good potential for some discretionary supply. These quarries should be investigated as prospective supply sources of roadbase and/or aggregates. Some are expected to become 'Strategic Quarries'.

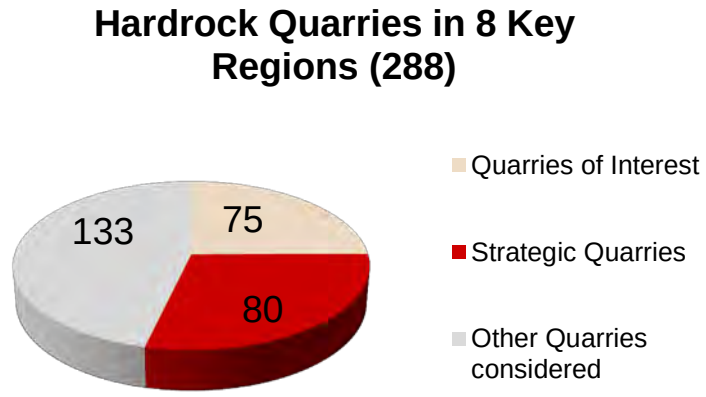


FIGURE 5: QLD HARD ROCK QUARRIES in the 8 REGIONS OF INTEREST

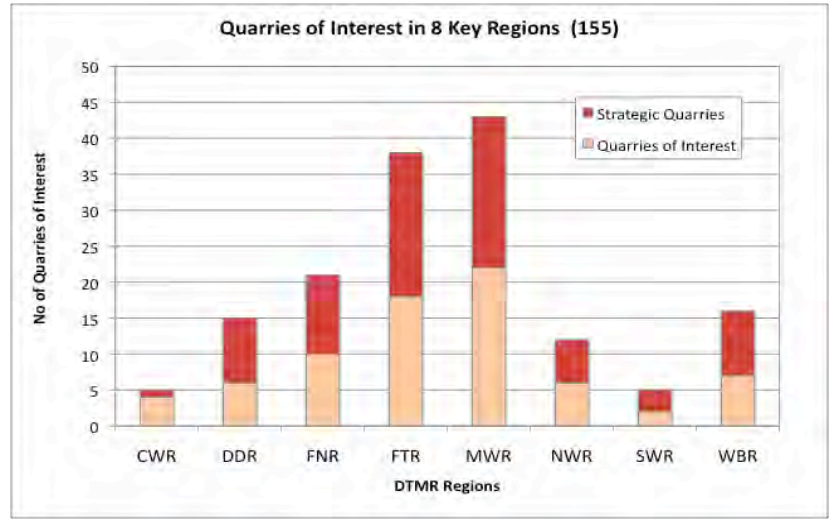


FIGURE 6: STRATEGIC QUARRIES AND QUARRIES OF INTEREST BY CDA

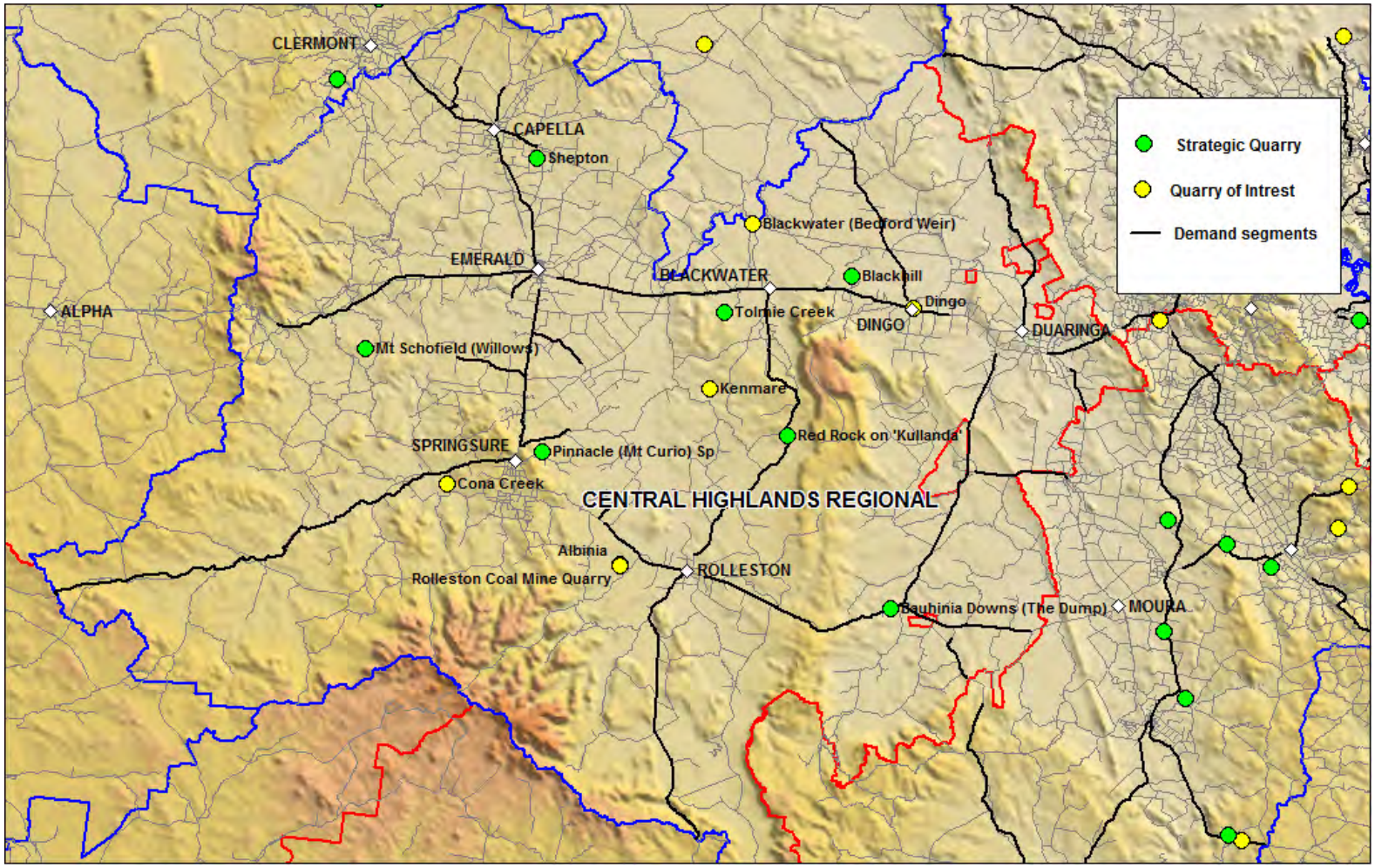
Strategic Quarries and Quarries of Interest for the Central Highlands LGA within the Fitzroy region are shown in Figure 7.

The damaged road segments requiring roadbase and aggregate materials over the period 2011 to 2014 are shown in black.

The TNRP All Quarries database indicates there are seven (7) strategic quarries in the Central Highlands Regional Council local government area, and six (6) quarries of interest.

The 3 largest operating quarries in the west are Shepton (CHRC), Tolmie Ck (Holcim) and Blackwater. Other 'campaign' quarries such as Mt Schofield and Blackhill are in strategic locations.

Quarries of Interest such as Cona Ck (resource not known but in a strategic location) and Albinia Quarry (within the boundary of a National park) are also strategically located, but constraints to supply may be intractable.



Source: All Quarries Database draft Jan 2012

FIGURE 7: STRATEGIC QUARRIES AND QUARRIES OF INTEREST
for CENTRAL HIGHLANDS LGA, FITZROY REGION

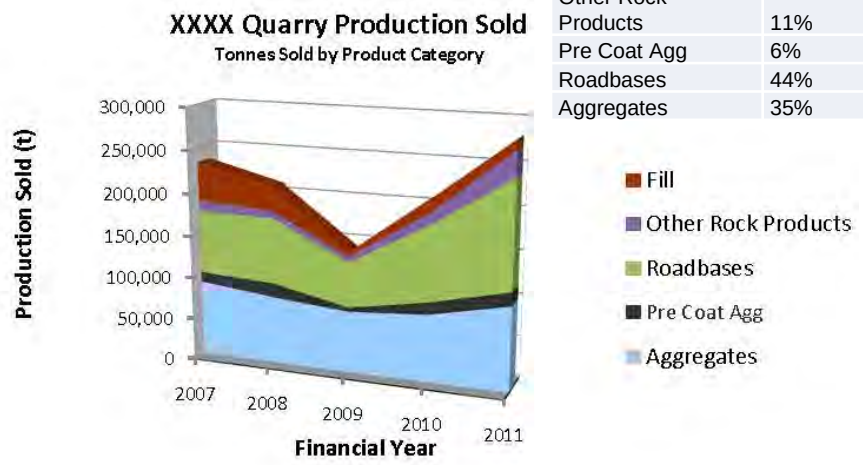
Figure 8 shows a typical 'production sold' profile, by year, and product type, for a quarry working a Tertiary Basalt deposit. Established quarries in established areas typically produce a range of crushed rock products depending on market demand and source rock quality.

Quarries use both fixed and mobile crushing and screening plant (processing plant) to produce roadbase and aggregate materials.

Fixed installations are used in established quarries with established markets.

Mobile plants are also used in established quarries (to increase production) but most typically for 'campaign crushing' where the quarry is worked on an 'as required' basis depending on demand from local projects.

The portability of mobile plants is their advantage, but there are 'trade offs' – they are usually less efficient, are harder to maintain (with attendant risk implications) and more costly to operate.



Product Sales FY 2011	% Sales tonnes
Fill	4%
Other Rock Products	11%
Pre Coat Agg	6%
Roadbases	44%
Aggregates	35%

FIGURE 8: EXAMPLE OF ANNUAL QUARRY PRODUCTION

FIXED V MOBILE CRUSHING & SCREENING PLANT

Fixed plants have a high capital cost ($6M to $60M depending on size and sophistication) but their productivity is higher, with availabilities as high as 90% in some modern plants.

Mobile plants cost about $6M for a 180-200 tph (2000 tpd) Type 2.1 roadbase plant (which can be easily reconfigured to produce 1500 tpd of aggregate). But the availability of these plants varies widely depending on application, age and the capabilities of the operator.

Industry report that availabilities (as low as 50% but) typically 60-65% as the norm in some regional areas of high demand. Naturally, this has a profound impact on what a plant can produce - month in month out. In the discretionary supply analysis for this study, estimates of monthly (conditional) discretionary capacity have been made, taking availability considerations into account.

Basalt and igneous rocks comprise the majority of source rocks in the Strategic Quarries and Quarries of Interest. The basalt quarry in the photo is using a mobile 170 tph crushing plant in the pit. Note the soil and overburden in the foreground and the different (dark and light) basalt materials in the rockface indicating variable quality.

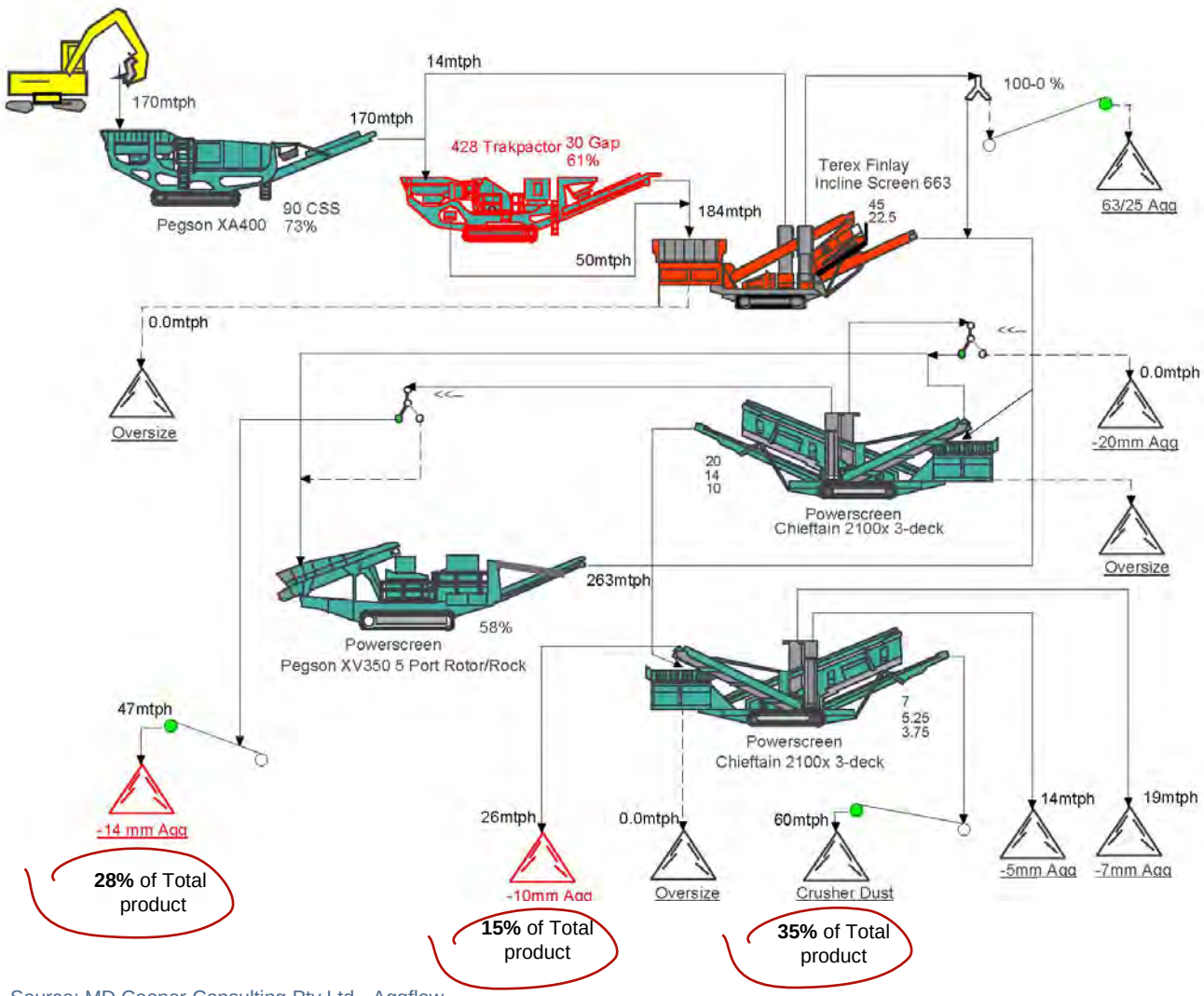
Both overburden and the presence of altered rock can impact on product quality and cost.

FIGURE 9 consists of a schematic diagram of a 170 tph mobile crushing and screening circuit, for a Basalt quarry producing roadbase, and aggregate (80% asphalt agg. and 20% cover aggregate).

The circuit shows the asphalt aggregate configuration and the 'yield' of each size fraction (in tonnes per hour).

In this circuit, crusher dust accounts for 35% of production, 28% is 14mm aggregate and 15% is 10mm aggregate. The actual yield of 16mm, 14mm and 10mm cover aggregate from the primary raw feed for a quarry is therefore a fundamental constraint to increased output.

Some quarries (particularly those that produce rail ballast) have commented that they can make roadbase and aggregates from the 'undersize' from rail ballast and it would help improve yield for 16mm pre-coat if a larger maximum particle size could be tolerated in the specification.



Source: MD Cooper Consulting Pty Ltd - Aggflow

FIGURE 9: EXAMPLE OF CRUSHING & SCREENING PLANT CIRCUIT

For the above circuit, 10mm aggregate comprises just 15% of total aggregate production.

PRE-COATED AGGREGATE

Precoating is the pre treatment of the aggregate with a thin film of bitumen compatible material, generally a petroleum based product, to:

i.Neutralise the effect of dust;

ii. Aid the initial "wetting" of the aggregate by the binder to improve the early retention of the aggregate and;

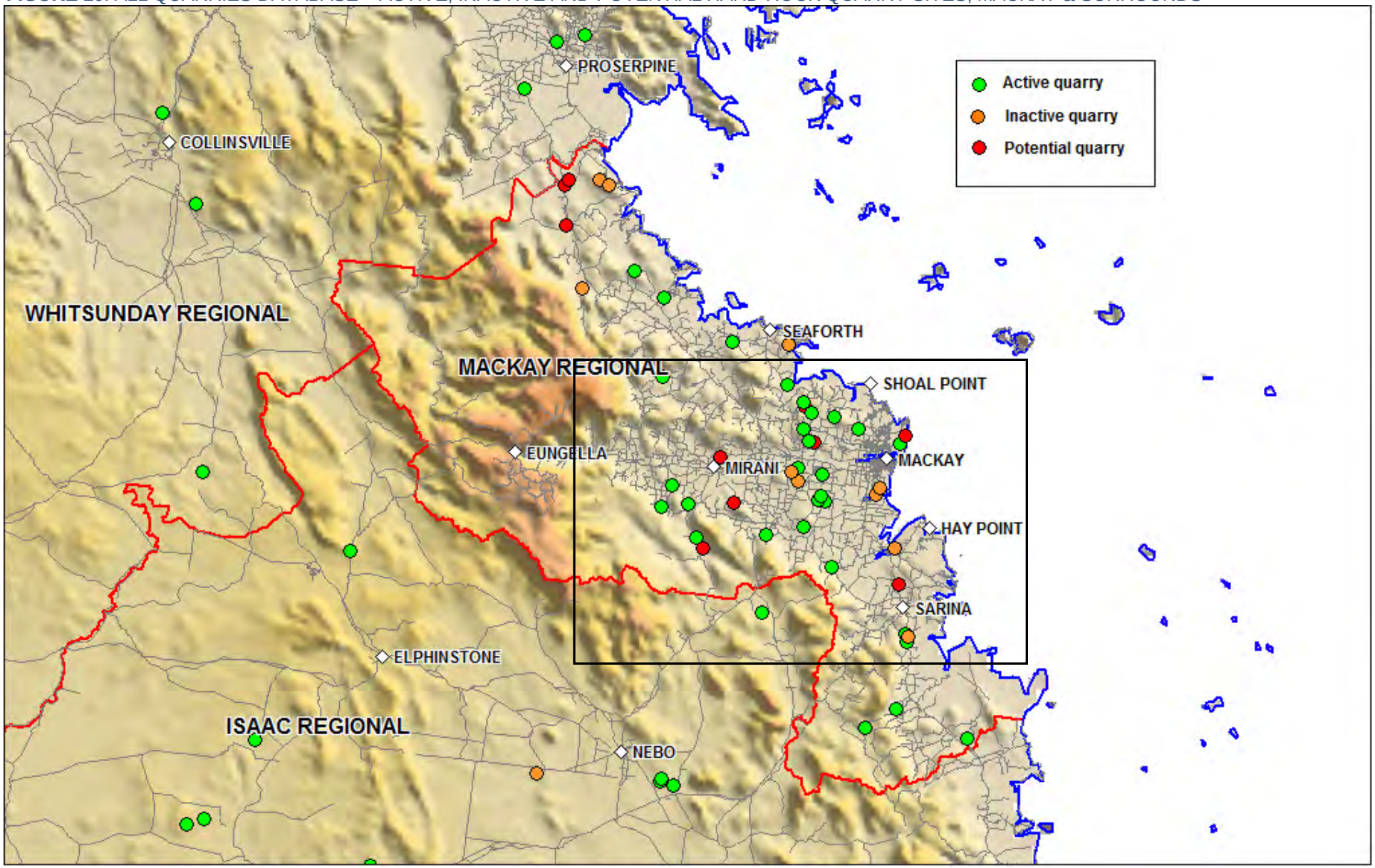
iii. Improve the bond of the binder to the aggregate.

The aggregate's surface chemistry and the presence of dust and water affect the bond between binder and aggregate.

Source: www.austroads.com.au

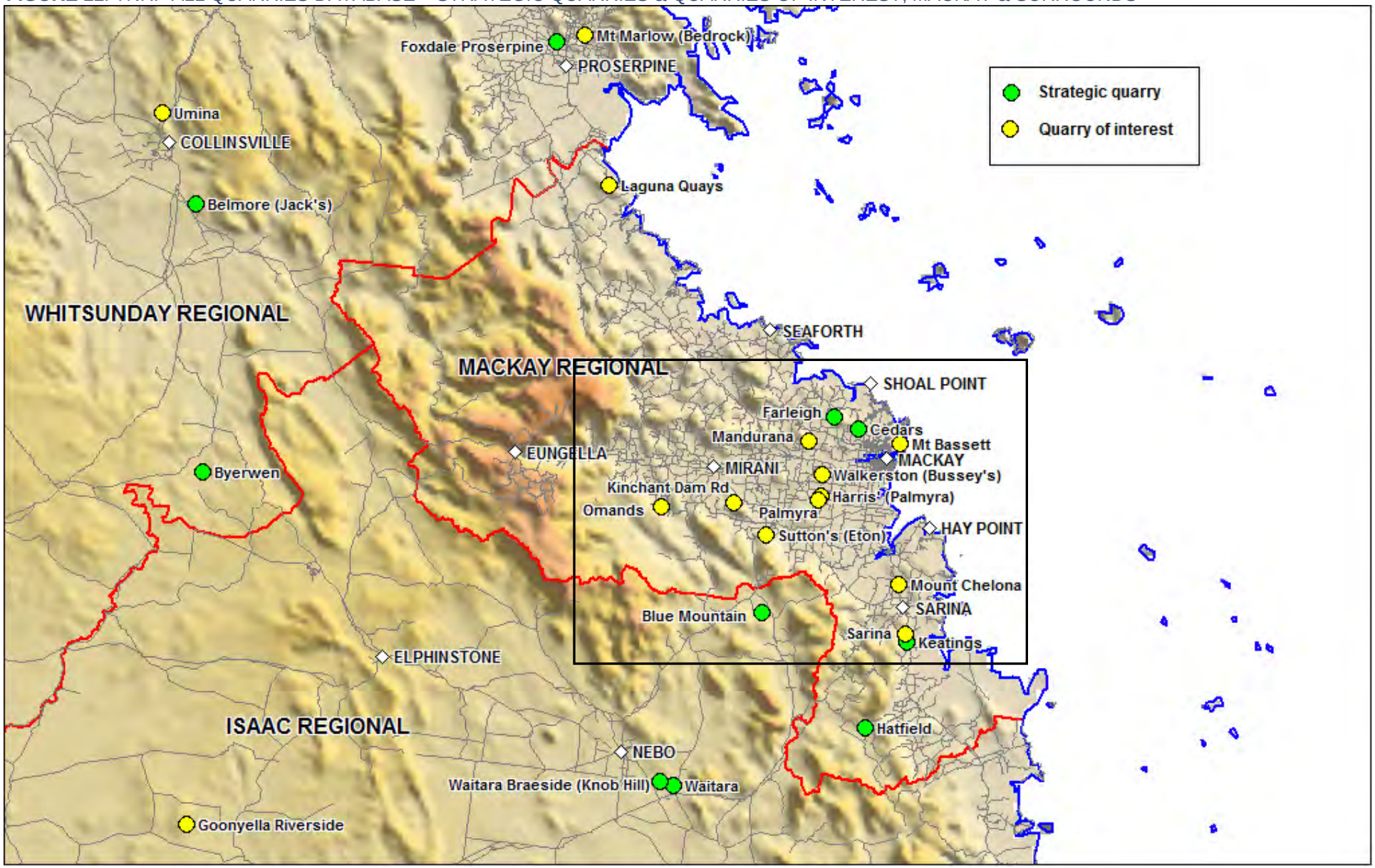
Note that only 38 (48%) of Strategic Quarries have indicated they have pre-coating facilities.

FIGURE 10: ALL QUARRIES DATABASE – ACTIVE, INACTIVE AND POTENTIAL HARD ROCK QUARRY SITES, MACKAY & SURROUNDS



Source: All Quarries Database, draft v7

FIGURE 11: TNRP ALL QUARRIES DATABASE – STRATEGIC QUARRIES & QUARRIES OF INTEREST, MACKAY & SURROUNDS



Source: All Quarries Database, draft v7

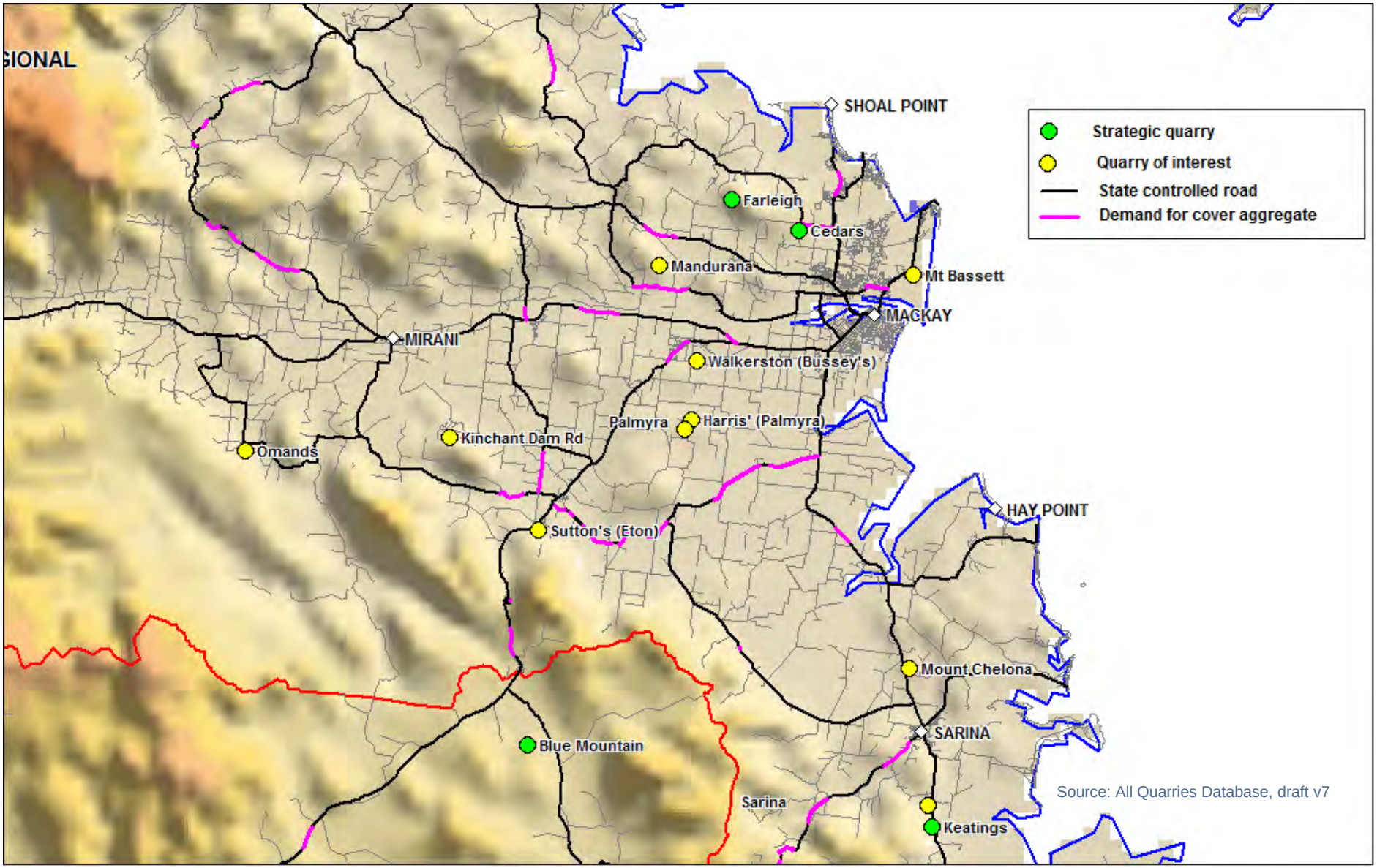


FIGURE 12: TNRP ALL QUARRIES DATABASE – STRATEGIC QUARRIES, QUARRIES OF INTEREST, COVER AGG DEMAND - MACKAY

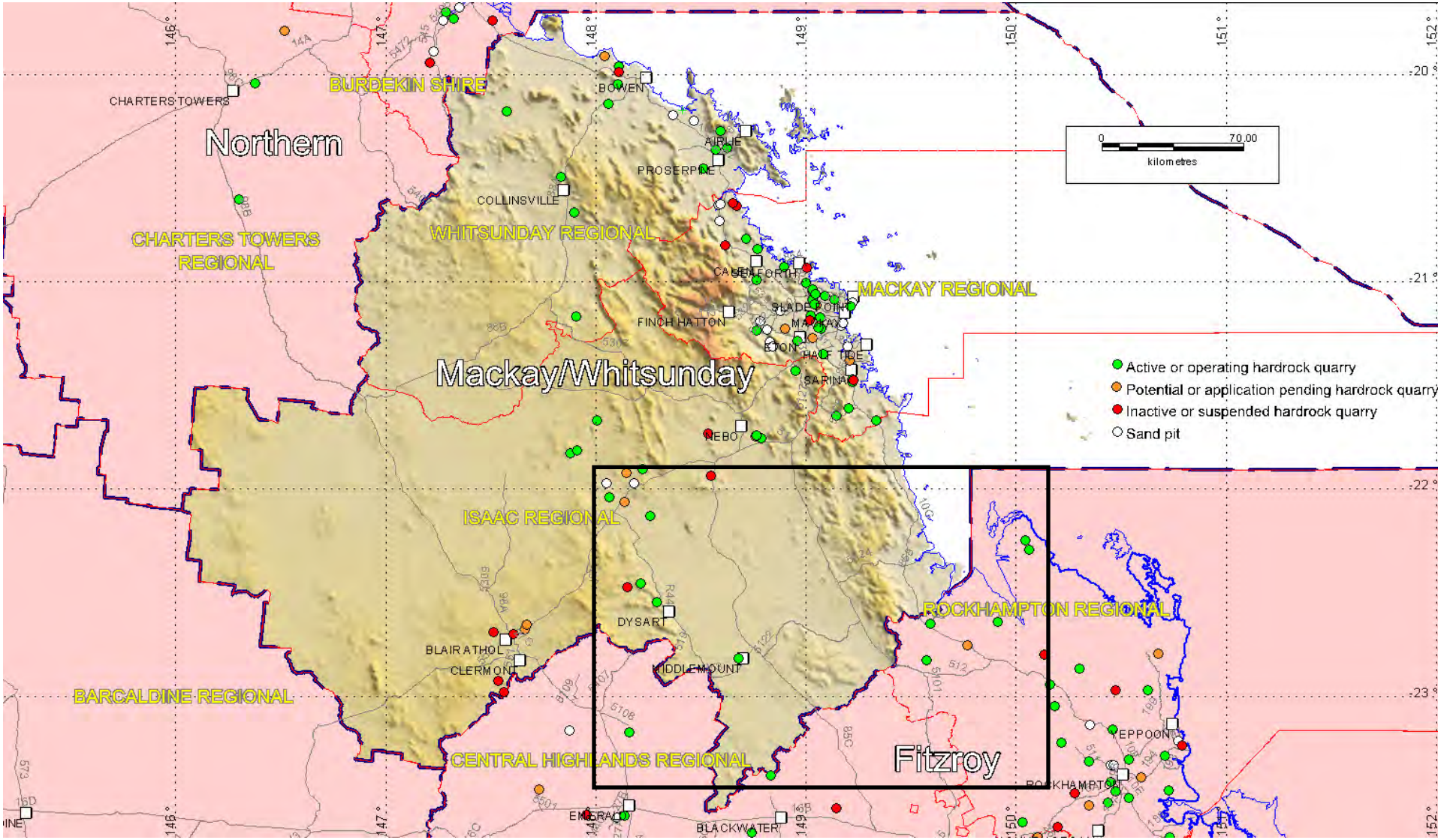


FIGURE 13: TNRP ALL QUARRIES DATABASE – Active, Inactive and Potential Quarries and Sand Pits – SE ISAAC REGION Source: All Quarries Database, draft v4

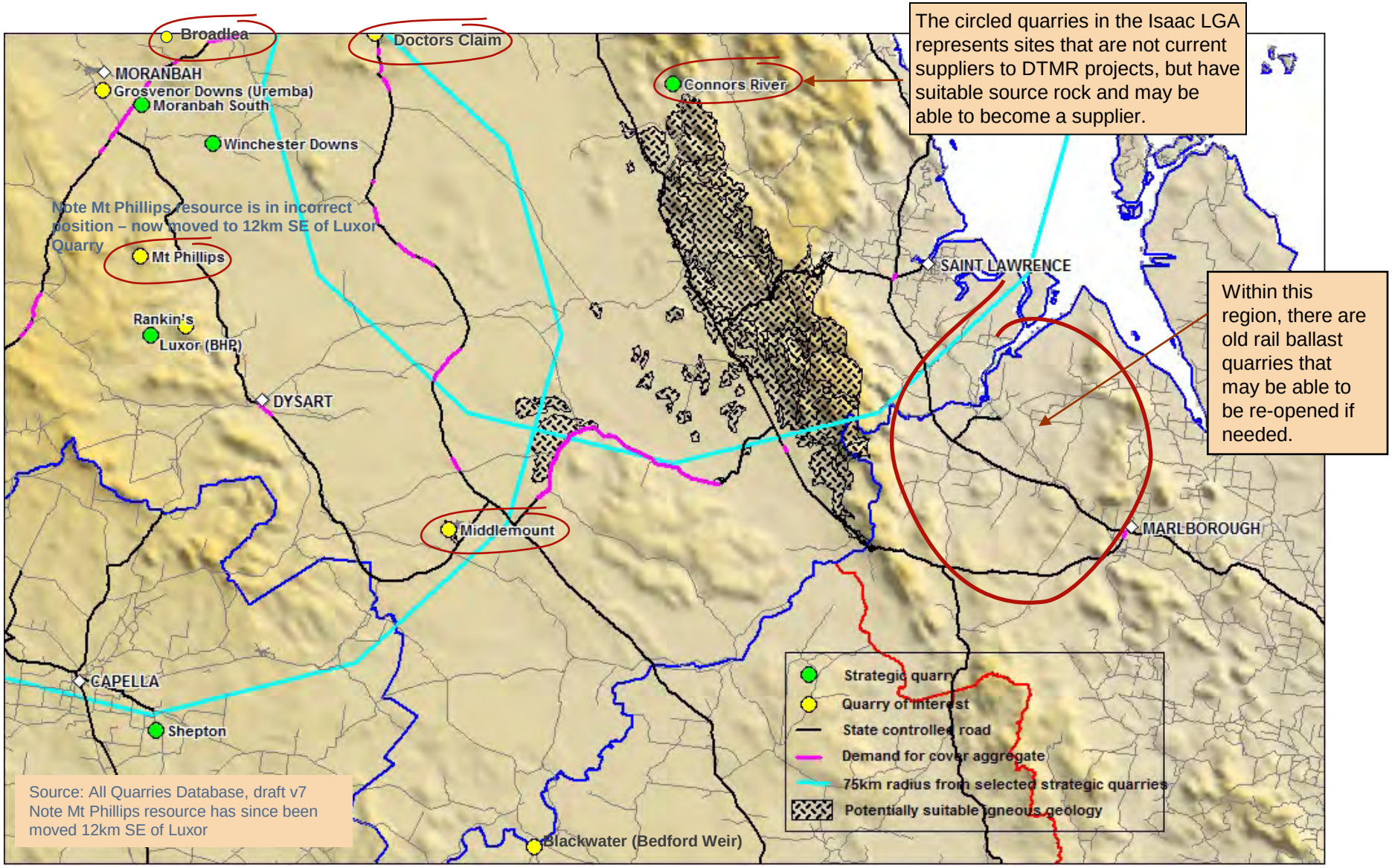


FIGURE 14: ISAAC REGION (SOUTHEAST) – QUARRIES, DISTRIBUTION RADII AND POTENTIAL RESOURCES (COVER AGGREGATES)

Qld consumes about 50 Mtpa of crushed rock products (principally roadbases and aggregates) per year.

On a per capita basis TNRP and Qld RA demand are adding approximately 27Mt over 32 months, which on an annualised basis equates to 10Mtpa or a 20% increase in demand across the board. The majority of the TNRP and LGA road reconstruction works are in regional areas and not South East Qld, so the additional proportional demand is higher in the regions.

Figure 16 shows an example of a time series of production of hard rock quarry products (for the Sunshine Coast). Per capita consumption varies between 8 to 14 tonnes.

In Mackay, total hard rock quarry output and per capita consumption has doubled in 5 years (to 15 tonnes per person) in response to the local economic (boom) conditions and demand for roads, housing, industrial land etc.

DERIVED DEMAND

Society's consumption of quarry products is often referred as being driven by 'derived' demand. The general public don't usually 'consume' aggregates directly, but rather demand for their use is 'derived' by the demand for the goods or services that aggregates or quarry products provide.

As the majority of aggregates and roadbase materials are used as inputs into construction materials for building and construction, their demand is driven largely by population growth, economic activity and specific major projects (eg highway works, port developments, rail infrastructure etc). Table 4 and FIGURE 15 indicate typical market segments.

Demand is frequently expressed on a per capita consumption basis (Refer FIGURE 16) – typically in Qld annual per capita demand for extractive materials averages about 11 tonnes. But longer-term averages can be misleading for forecasting, especially during periods of peak demand.

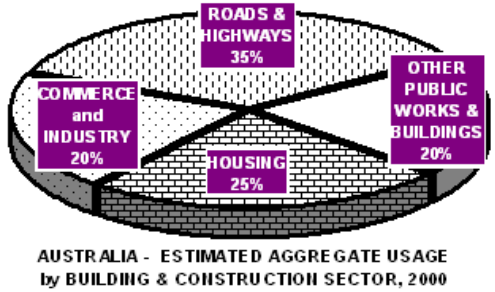


FIGURE 15: ESTIMATE OF AGGREGATE USAGE BY CONSTRUCTION ACTIVITY IN AUSTRALIA (IQA 2000)

Type of Building Activity or Customer	Typical Examples
1. Builders	Residential, commercial/ industrial
2. Civil Contractors	Major civil projects; drainage; road building/surfacing; ports; pipelines etc
3. Government / Major Projects	Local, State and Federal government civil infrastructure (eg highways, ports, water supplies, railways)
4. Manufacturers	Asphalt; premixed concrete; precast concrete; soil products
5. Resellers	Cartage companies; landscape yards; independent users of aggregates
6. Subcontractors	Concretors; electrical; landscapers; plumbers
7. Rural & COD	Rural property owners, cash customers

TABLE 4: QUARRY MARKETS – SEGMENTATION BY ACTIVITY AND CUSTOMER TYPE Source Ecoroc 2010

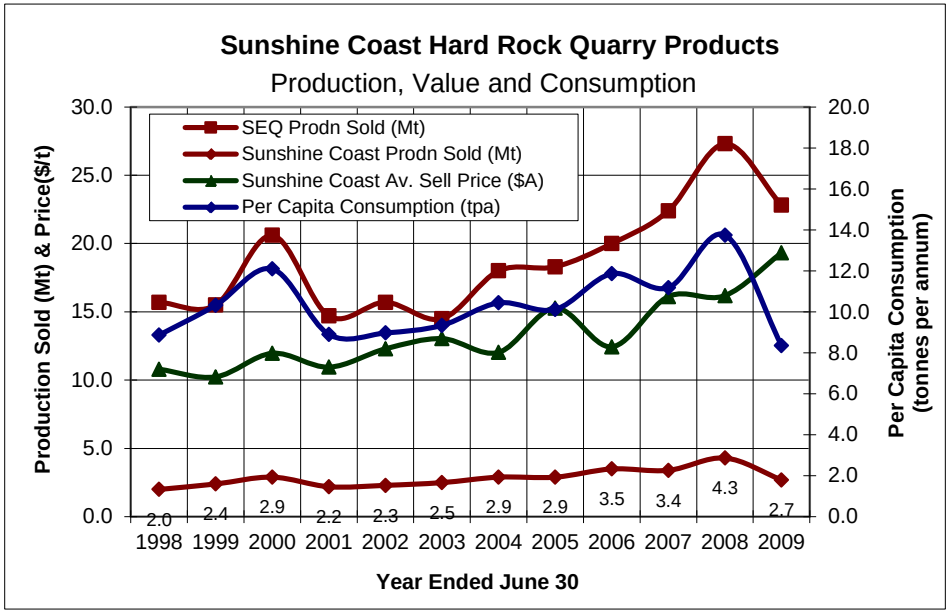


FIGURE 16: DEMAND FOR HARD ROCK QUARRY PRODUCTS – SUNSHINE COAST TIME SERIES 1998 TO 2009

Source DEEDI data, Ecoroc 2010, prices unadjusted for inflation

'Need' for extractive materials can be expressed as the shortfall between demand and supply.

Modeling of demand for Type 2.1 (2.2) roadbase and cover aggregates has been undertaken for the most-affected Critical Demand Areas in Regional Queensland.

Demand projections developed as part of the quarry study are based on projected demand from DTMR and Qld RA road construction projects, Q-Trip projects, and where applicable, demand from major mine, gas, rail and port related projects.

Aggregated underlying, baseline or historical demand, whilst of interest, is not particularly useful in predicting future supply over the short-term. This is illustrated in FIGURE 17, where the demand spike for hard rock materials in Qld (outside SEQ) in FY 2011 is not apparent from any trend in the historical time series data.

For this TNRP quarry study, only demand from the four described 'demand drivers' are considered, and only discretionary (additional) supply from quarries is of strategic interest.

DEFINITIONS AND ASSUMPTIONS INHERENT IN CALCULATION OF DEMAND VS SUPPLY CHARTS FOR CDA'S

DEMAND

Analysis is restricted to two key commodities:

- Roadbase: Specifically Type 2.1 & Type 2.2 Unbound Pavement Material (T2.1+T2.2 UPM in database); and
- Cover Aggregate (CoverAgg in database)

Monthly and cumulative demand figures are made up of the following components (where applicable):

1. TNRP Demand
2. LGA Demand
3. Q TRIP Demand
4. Other (includes Mining/Major Projects, or 'Black Hole' Demand)

DTMR estimates that Roadbase material is generally split (in the Eastern regions (but not Western Qld) in the following proportions:

Type (MRS 11.05)	% in Pavement
T2.1	30%
T2.2	30%
T2.3	30%
T2.4 + T2.5	10%

TABLE 5. BREAKDOWN OF ROADBASE COMPOSITION

1. TNRP Demand

The fraction of Quarry Materials assigned to T2.1+T2.2 is 60% as per the above table.

CoverAgg is made up of a combination of 10 mm, 14 mm and 16 mm nominally sized aggregates.

2. LGA Demand

Ridge and Quarry Gravels are made up of 95% Roadbase products and 5% CoverAgg.

The fraction of Ridge and Quarry Gravels assigned to T2.1+T2.2 UPM is therefore 95% x 60% = 57%

CoverAgg is 5% of Ridge and Quarry Gravels

3. Q TRIP Demand

Where QTRIP data for roadbase and/or aggregate is shown for a region, this is incorporated into the database as shown in the estimates supplied for the first 6 months. For subsequent months, an average monthly figure based on the first 6 months demand is entered.

4. Mining-related Demand

A figure is entered monthly for T2.1-T2.2 that is the annual estimate of quarry materials multiplied by 35% and divided by 12.

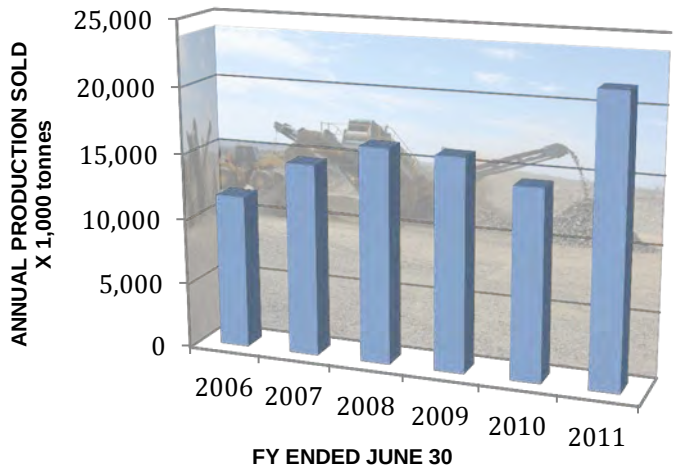


FIGURE 17: HARD ROCK QUARRY PRODUCTION IN REGIONAL QLD (Excludes SEQ)

Short-term demand in Critical Demand Areas is difficult to predict from historical reported quarry production.

FIGURE 18 shows a comparison of FY 2010 & FY 2011 reported production sold from hard rock quarries in the Mackay/ Whitsunday Main Roads region, and the 2012 forecast total sales estimated by Ecoroc (based on market enquiries and estimates completed as part of this study).

These data indicate that total production sold is predicted to be 49% higher in FY 2012 compared with FY 2011, which itself represented a 50% increase on FY 2010.

Not all the 'growth' in Figure 18 is likely to be from increased production alone. Some of the historical difference is likely attributable to 'under reporting' or non-reported production from quarries (reporting production to DEEDI is voluntary).

By modeling additional demand (from TNRP etc) and discretionary additional supply from quarries, areas of uncertainty in forecasting underlying demand, can be circumvented for the TNRP quarry supply analysis.

CHANGES IN SHORT-TERM DEMAND

Figure 18 shows a chart of annual production sold in the Mackay, Isaac and Whitsunday LGA's for years FY 2010, 2011 and 2012 (forecast).

The data for FY 2010 and 2011 are 'Quarry Production Sold' as reported by quarries to DEEDI (Mineral and Extractive Planning Unit). The % figure is the YoY increase from FY 2011 to FY 2012 (forecast).

Whilst the data are the best available to government, in CDA's historical reported production is not particularly useful in predicting short-term peak demand.

There are two principal reasons for this:

Firstly, historical time series of quarry production whilst useful for long term planning, cannot predict volatility in demand (production) over the short run; and

Secondly, not all quarry production is reported.

This latter factor is probably more prevalent in regional areas; where quarries are close to or exceeding production limits set by DA's or license conditions; and for quarries where the production is project specific and not necessarily servicing the open market (eg civil projects, mine sites).

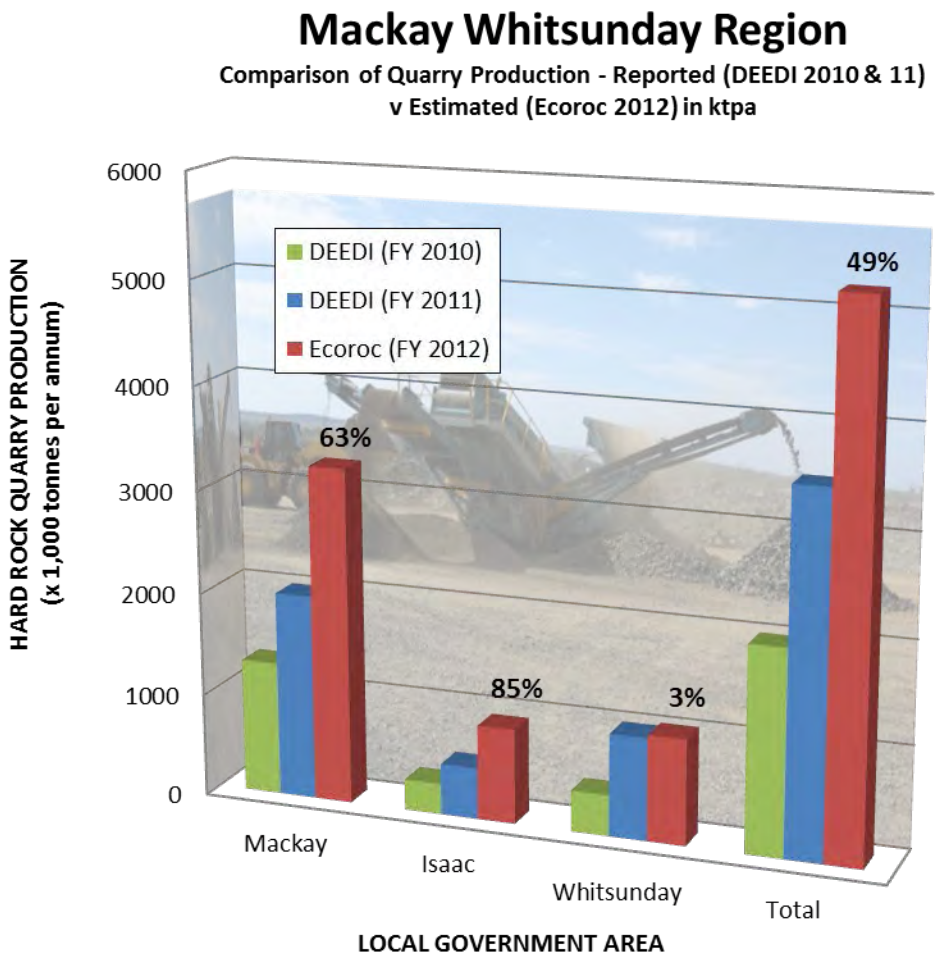


FIGURE 18: COMPARISON OF YEAR ON YEAR (YoY) QUARRY 'PRODUCTION SOLD' FOR MACKAY WHITSUNDAY REGION
(FY 2012 is a forecast by Ecoroc)

For CDA's such as Mackay/Whitsunday, Fitzroy, South West and Darling Downs regions, monthly and cumulative demand figures are made up of the following components :

1.TNRP Demand

2.LGA Demand

3.QTRIP Demand (where applicable)

An estimate of demand from Major Projects such as coal mines, and railway lines has been separately made (for the Bowen, Galilee and Surat basins) – refer Section 6.

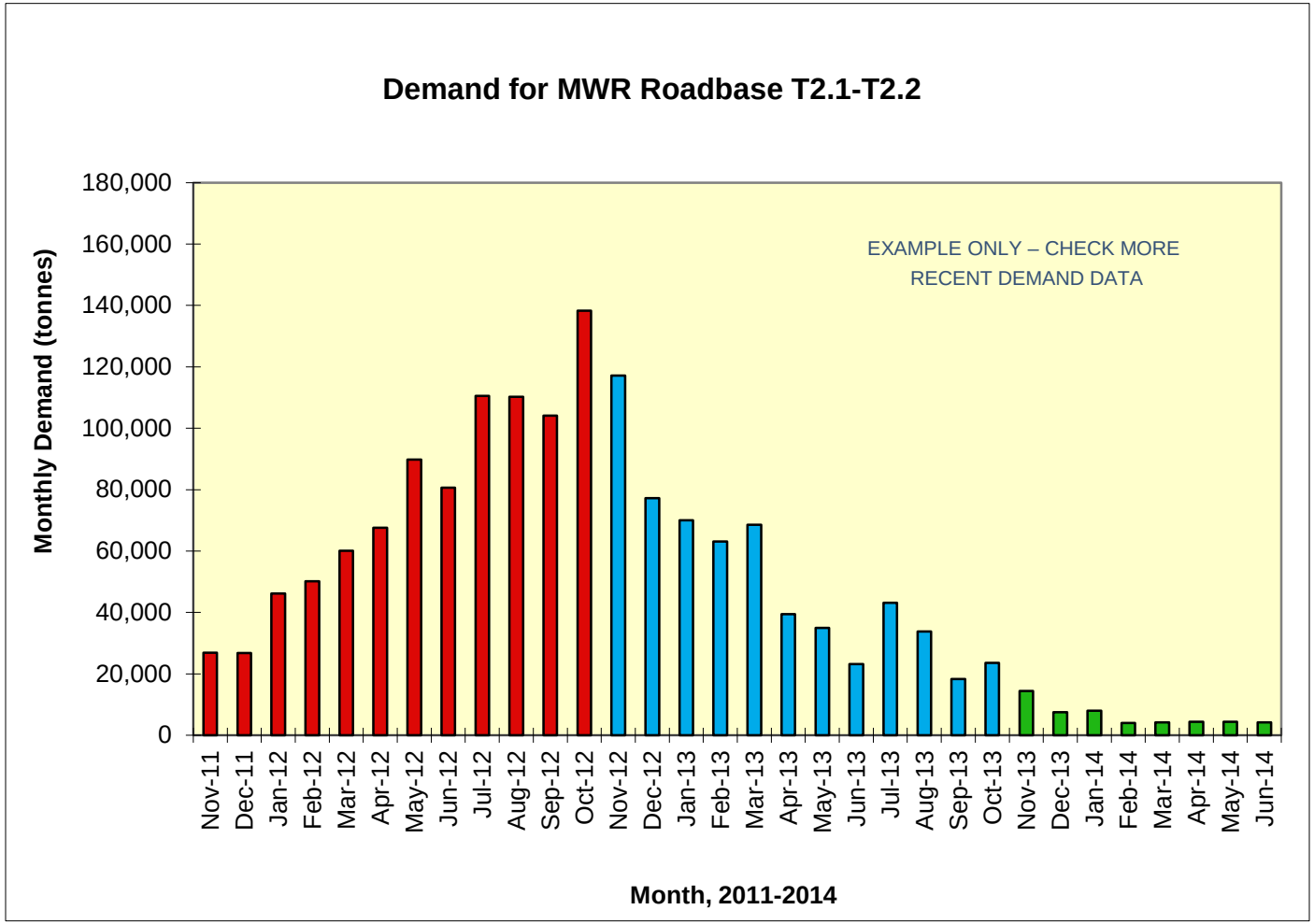


FIGURE 19: MACKAY WHITSUNDAY REGION – TNRP, QLD RA and Q Trip MONTHLY DEMAND for TYPE 2.1 and 2.2 ROADBASE

For CDA's such as Mackay/Whitsunday, Fitzroy, South West and Darling Downs regions, monthly and cumulative demand figures are made up of the following components :

1.TNRP Demand

2.LGA Demand

3.QTRIP Demand (where applicable)

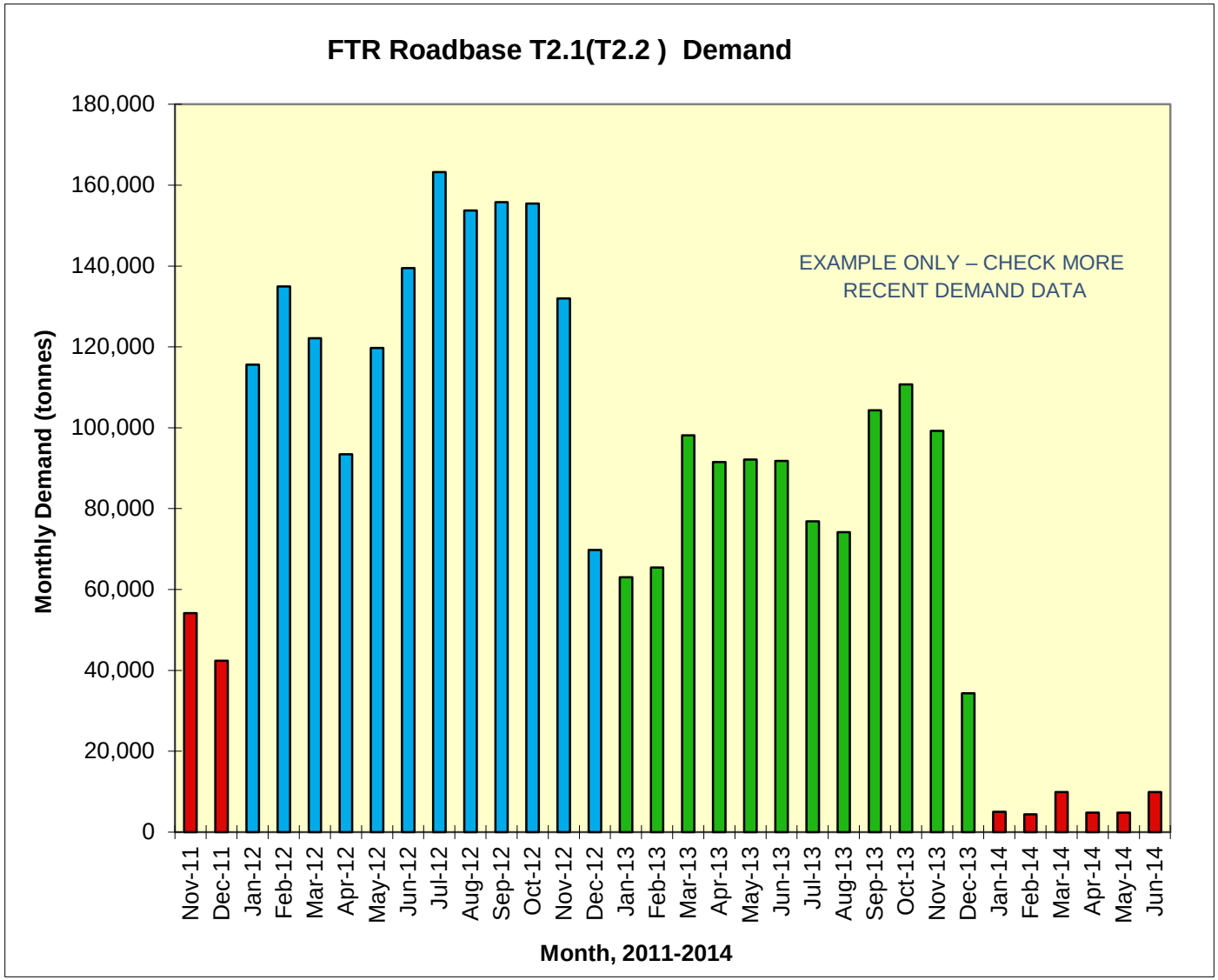


FIGURE 20: FITZROY REGION – TNRP, QLD RA and Q Trip MONTHLY DEMAND for TYPE 2.1 and 2.2 ROADBASE

For CDA's such as Mackay/Whitsunday, Fitzroy, South West and Darling Downs regions, monthly and cumulative demand figures are made up of the following components :

1.TNRP Demand

2.LGA Demand

3.QTRIP Demand (where applicable)

The chart in FIGURE 21 also indicates 'Cumulative Demand' (on the RHS vertical axis) and a 'Do Nothing' scenario, which as it suggests is the 'modelled' industry supply response without any specific efforts to overcome bottleneck/supply side constraints.

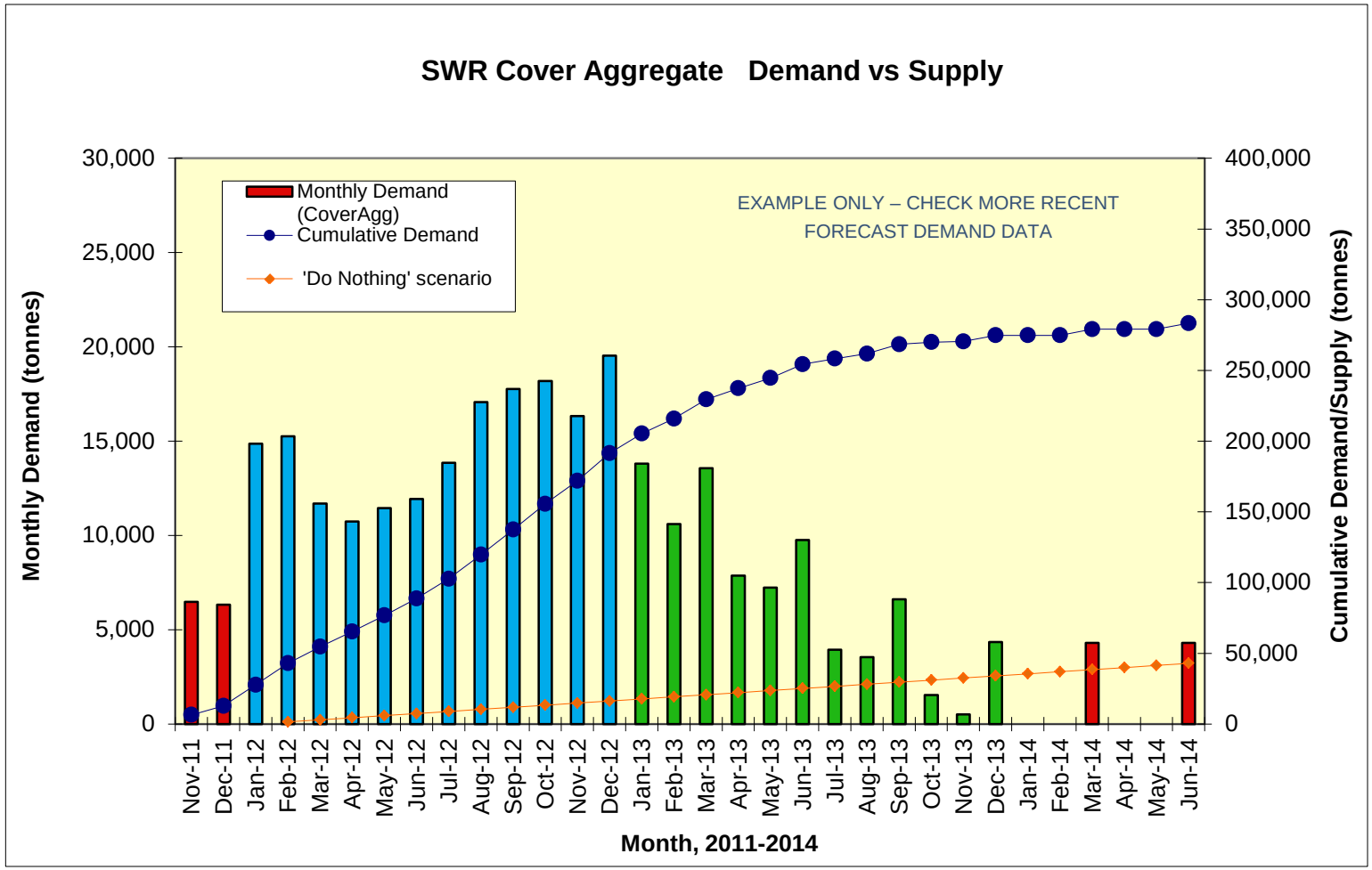


FIGURE 21: SOUTH WEST REGION - MONTHLY DEMAND for COVER AGGREGATE WITH 'DO NOTHING' SCENARIO

Ausrocks on behalf of Ecoroc completed an assessment of demand for quarry products from major projects in the Bowen Basin.

Over the period from 2012 to 2015 an estimated 15 Mt of crushed rock products will be consumed by coal mine and rail line development in the Bowen, Surat and Galilee Basins.

Whilst clearly this impacts on discretionary supply to TNRP projects, the supply capacity itself largely exists because of the foreseeable and sustained demand from coal mines and their infrastructure needs.

In contrast, port infrastructure projects tend to act as 'blackholes' consuming all available supply of quarry (crushed rock) products (eg Abbot Point, Gladstone).

CSG wells and pipelines consume considerably less crushed rock products.

KEY FINDINGS: COMPETING DEMAND FROM MAJOR PROJECTS FOR CRUSHED ROCK PRODUCTS

On behalf of Ecoroc, Ausrocks (2012) completed a review of the demand from major projects in the Bowen Basin (Mackay Region) for hard rock quarry materials and implications for quarry supply to TNRP projects. The findings, based on consultations with industry, quarries and contract crushing firms include:

1. A new coal mine development requires 250-350 kt of crushed rock products for mine development

2. A coal mine producing 10Mt/a of coal typically uses about 400 ktpa of crushed rock (quarry) materials for roadways, ramps, hardstand areas and stemming of blastholes. It is easier to meet the mines specification than DTMR specification.

3. The construction of a metre of rail line consumes approximately 12 tonnes of rail ballast. Quarries report that demand from major projects such as mining projects is much easier to schedule, whereas monthly DTMR project demands are variable and therefore more difficult to schedule.

4. A number of quarries are running close to peak output to supply coal mine demands in the Bowen Basin and are ramping up to supply increased demand. So peak monthly demands from DTMR may not be achievable, given the increase in base load supply for committed projects.

5. There is a shortage of mobile plant for crushing and screening - plant is being sourced from SEQ and WA, if available.

6. The premium to attract quarry operators results in a 30% increase in labour cost over SEQ quarries so increased supply to DTMR projects will cost more.

7. QR contracts (rail ballast) leave "rejects" that are good for road base and aggregates. Eg Undersize from ballast jobs can be used to make roadbase and aggregates but there is some wastage in the upper size of the undersized aggregate because of the pre-coat spec.

For the period 2012 to 2014, Ausrocks data suggests the following additional demand for crushed rock products from coal mining and related rail and port infrastructure:

- New coal projects = 2.7 Mt (majority from Mackay Whitsunday Region);
- Expanding coal mines = 2.6 Mt;
- Demand from major infrastructure projects (railway line, port development etc) ~ 4 Mt.

Collectively this equates to 9.3 Mt of additional crushed rock demand, over 3 years.

DEMAND FROM COAL MINES AND MAJOR PROJECTS – Ausrocks 2012

Total 'Black Hole' demand (eg mine, rail and port development) is estimated to require 15 Mt of crushed rock products over the period 2012-2015.

In the next four years, commencement of 15 new coal projects will occur generating additional crushed rock demand of 1.8Mt/a by 2015 for these projects.

The extra quarry material demand for 11 expanding coal mines in Queensland is 3.5 Mt from 2012-2015, mostly from the Mackay – Whitsunday region.

Extra demand in the Mackay-Whitsunday Region is in the range of 1.2-1.4 Mt/a in 2014-2015.

Demand for the Xstrata Wandoan project will be met by the new nearby Weringa Quarry, currently in Development Application stage.

Major infrastructure projects are commencing over the 2-year time frame 2013-2014. In most cases port and rail projects are not dependent on existing quarry supplies, except for specialist materials (concrete, ballast and capping rock). Demand from port and associated development is estimated at 4 Mt over the period 2012-2014.

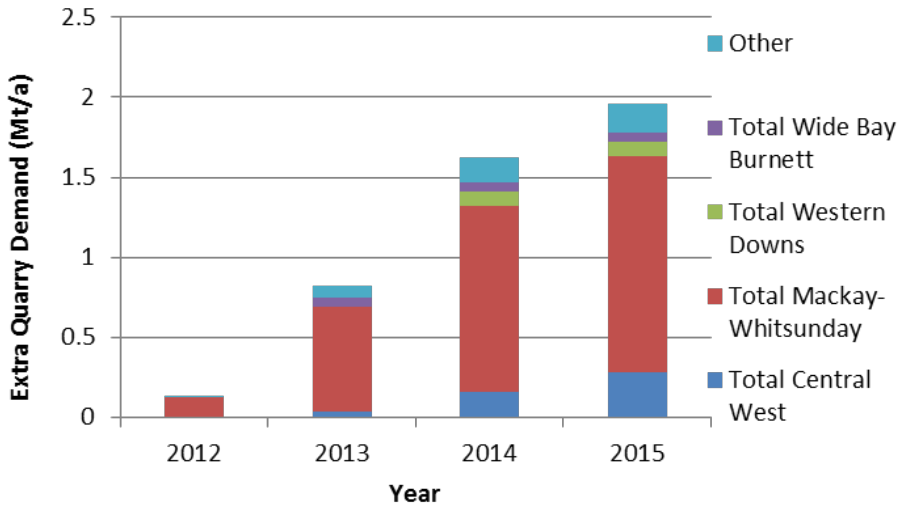


FIGURE 22: ESTIMATED ADDITIONAL DEMAND FOR QUARRY MATERIALS FROM NEW COAL PROJECTS IN QLD 2012 TO 2015

Source Ausrocks, market research Jan 2012

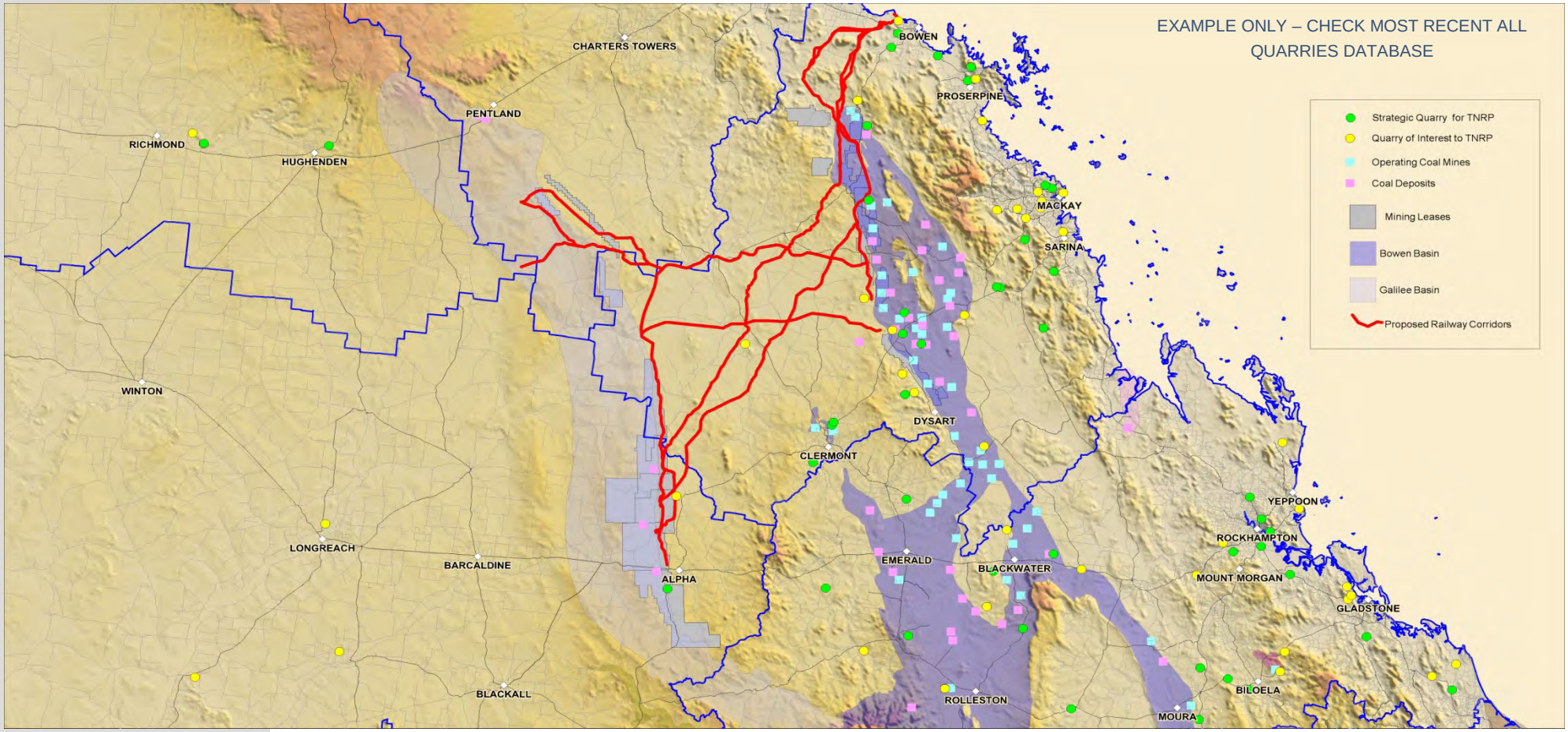


FIGURE 23 (a) BOW EN AND GALILEE BASINS – QUARRY LOCATIONS AND MAJOR PROJECTS (NEW AND EXISTING COAL MINES), PROPOSED RAIL LINE(S)

FIGURE 23a shows the location of Strategic Quarries and Quarries of Interest for the northern section of the Bowen and Galilee Basins along with operating coal mines, new coal deposits and various railway corridor options for the Galilee Basin.

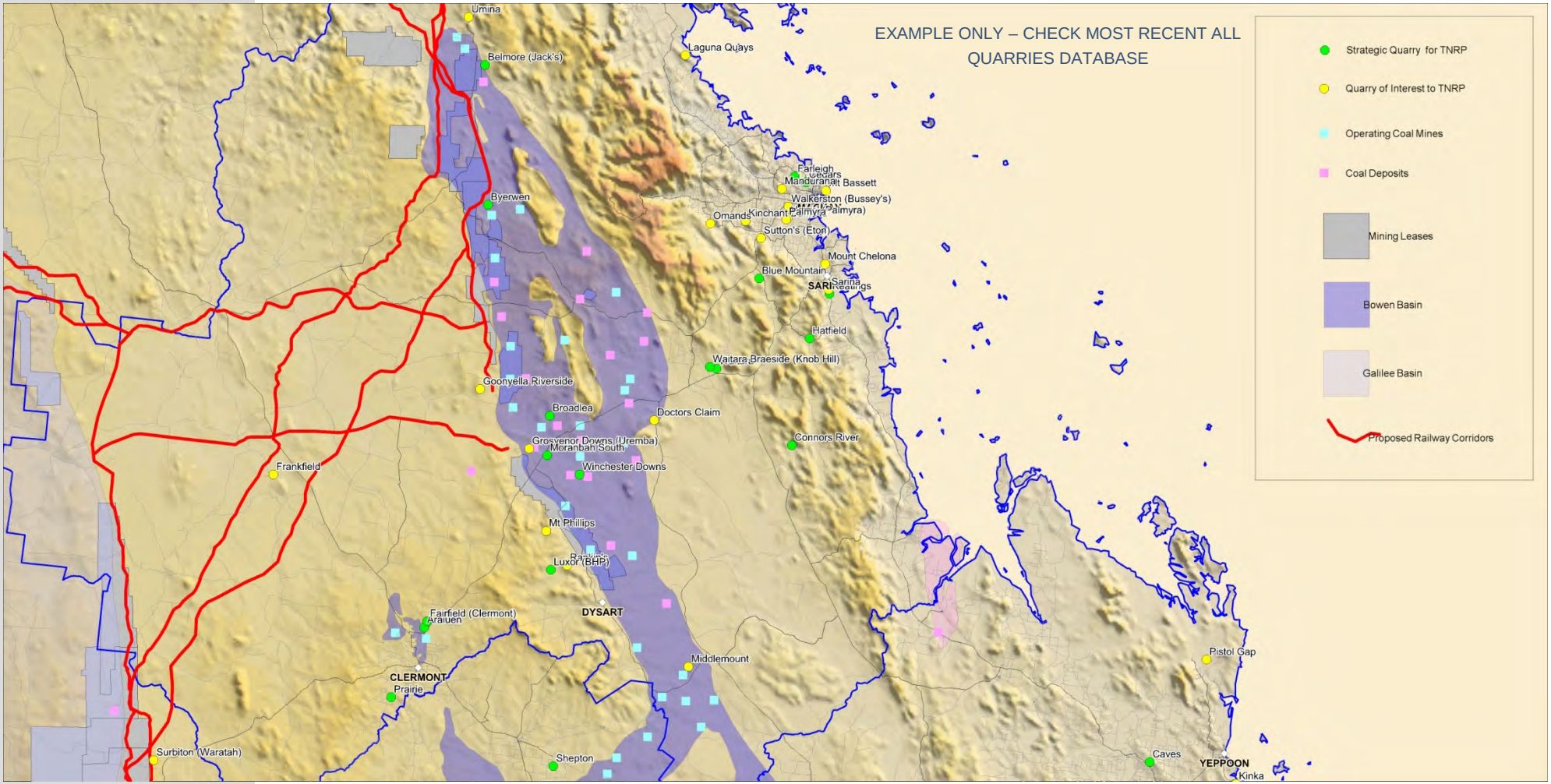


FIGURE 23 (b) BOWEN AND GALILEE BASINS – QUARRY LOCATIONS AND MAJOR PROJECTS (NEW AND EXISTING COAL MINES), PROPOSED RAIL LINE(S)

TRADITIONAL SUPPLY AND DEMAND CURVES

P indicates price
Q indicates quantity in a period of time (eg tonnes sold per year).

The intersection of the demand curve **D1** with the supply curve **S1** shows the prices (**P1**) that users are willing to pay for quarry products, at a 'normal' level of supply (**Q1**).

If 'new' extractive resources could be quickly brought into production in CDA's, then the supply curve would shift from **S1** to **S2**.

But at the higher levels of demand, the supply side response becomes more limited. Lead times to gain approvals for new quarries can take years and cost hundreds of thousands of dollars.

Under such conditions, incumbent quarries have a choice of discretionary supply and customers must 'compete' for remaining production.

With the mining and related infrastructure boom, the demand curve shifts to **D2** (current position) and to **D3** (caused by additional TNRP, Qld RA and 'major project' demand).

If 'new' extractive resources could be quickly brought into production, then the supply curve would shift from **S1** to **S2,** thus increasing the quantity of materials available, and moderating the price.

However, the supply-side (industry) response is more limited than this, and it is not of itself, a feasible solution to resolve quarry material shortfalls in CDA's.

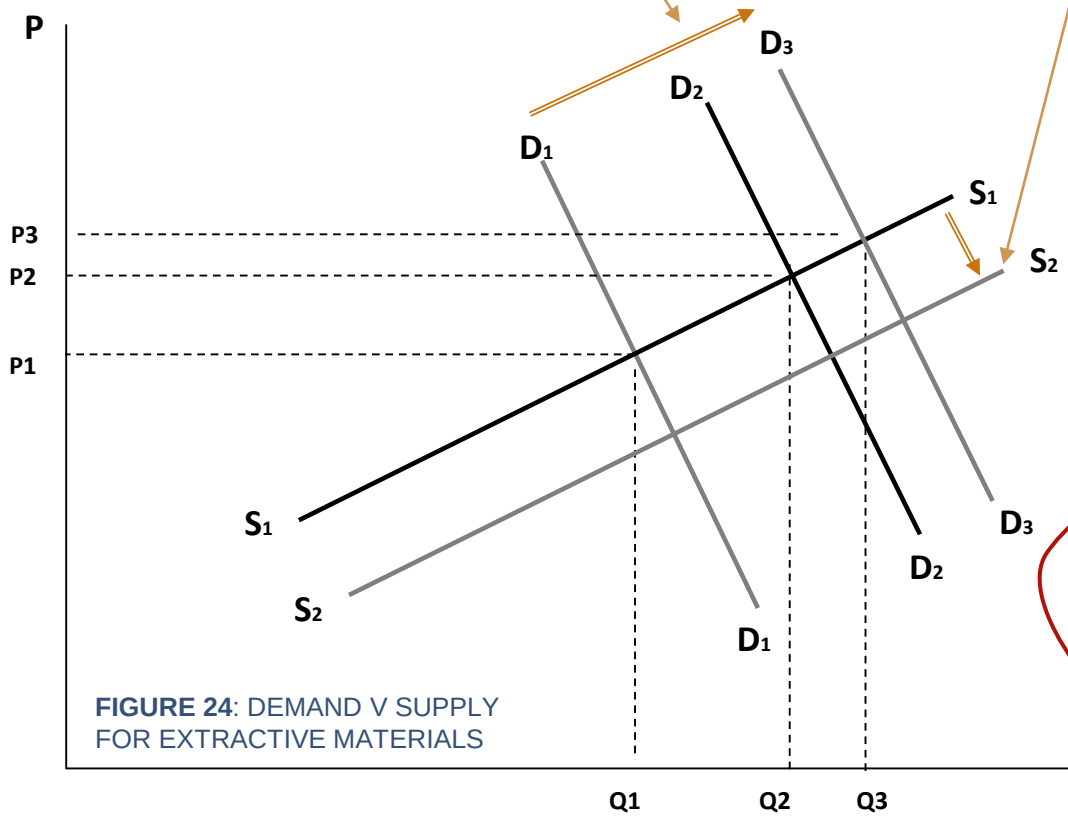


FIGURE 24: DEMAND V SUPPLY FOR EXTRACTIVE MATERIALS

Source: Ecoroc (2012)

LIMITS IN CDA'S TO INCREASING SUPPLY FROM NEW RESOURCES

In the Critical Demand Areas of Qld, the supply curve is pushing upwards (becoming more "inelastic") as demand intensifies and there are limits to the quarrying industry's capacity to respond.

Some hard rock quarries under development (or approval pending) will provide new supply sources, but the vast majority of TNRP demand will need to be satisfied from existing hard rock quarries.

SUPPLY AND DEMAND CURVES -EFFECT OF CONSTRAINED SUPPLY OF QUARRY PRODUCTS

P indicates price

Q indicates quantity in a period of time (eg tonnes sold per year).

With the mining and related infrastructure boom, the demand curve shifts to **D2** (current position) and thence to **D3** (anticipated from additional TNRP and Qld RA demand).

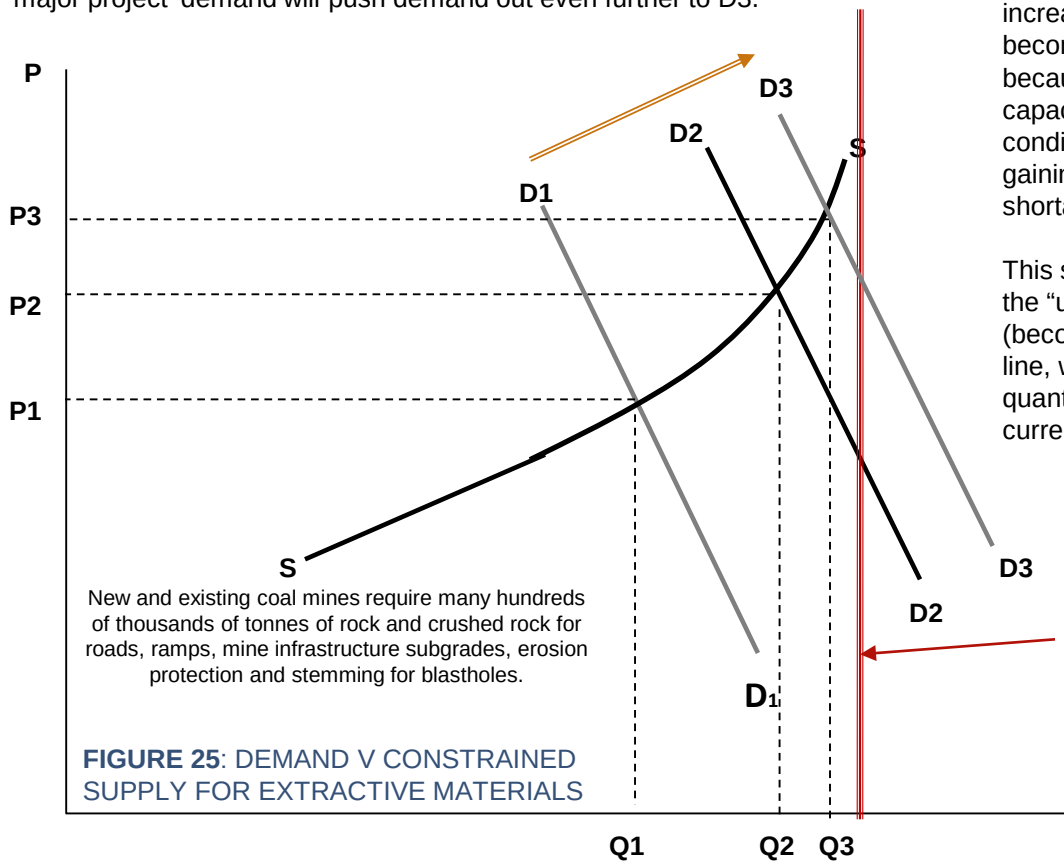
The quarrying industry supply response (shown by curve **S-S)** trends upwards, as various factors combine to limit production at quarries.

Customers must 'compete' for any remaining discretionary supply capacity from quarries.

Quarries in coal mining regions report a preference to supply roadbase and aggregate to the mines, because the specifications are not as tight, margins are good, supply is long-term and there is less commercial risk.

In Critical Demand Areas such as the **Bowen Basin** (Mackay ~ Fitzroy Region), demand for extractive materials from port, mine and railway projects is occurring on top of underlying construction, road-building and housing demand. Annual per capita consumption of crushed rock in coastal Qld averages about 8 tonnes – in the Mackay/Whitsunday region it is almost 15 tonnes. The supply of quarry materials is therefore constrained as quarries reach or approach maximum output - with limits set by (i) processing plant capacity, (ii) stockpile constraints (no stock or no room), (iii) production limits set by license conditions, (iv) difficulty in gaining development approvals, (v) labour (accommodation) shortages and (vi) truck shortages during periods of peak demand. Quarrying costs in the Bowen Basin are typically 30% higher than those in metropolitan areas. In Gladstone, total quarrying costs are reportedly 20% higher than 'normal'.

As demand for crushed rock products in CDA's increases, the demand curve shifts out to the right eg from D1 to D2. TNRP, Qld RA and 'major project' demand will push demand out even further to D3.



New and existing coal mines require many hundreds of thousands of tonnes of rock and crushed rock for roads, ramps, mine infrastructure subgrades, erosion protection and stemming for blastholes.

FIGURE 25: DEMAND V CONSTRAINED SUPPLY FOR EXTRACTIVE MATERIALS

As production of crushed rock products increases, additional further supply becomes limited (or severely constrained) because of limits to processing plant capacity, stockpile capacity, licence conditions which restrict output, difficulty in gaining approvals and labour and truck shortages.

This situation is illustrated in the model by the "upwards" curving supply curve S-S (becoming "inelastic") and the vertical red line, which represents the maximum quantity that the industry can supply under current conditions.

The quarrying industry supply response is limited unless constraints to further supply of hard rock quarry materials in CDA's can be overcome.

Source: Ecoroc (2012)

MOST INFLUENTIAL SUPPLY-SIDE CONSTRAINTS

Economic, market, processing, distribution and approval /licensing factors are likely to exert the most influence on the capacity of quarries to provide discretionary supply to TNRP works over the period 2012 to 2014.

These factors are highlighted in FIGURE 26: QUARRY ASSESSMENT FRAMEWORK – SUPPLY SIDE CONSTRAINTS for the Critical Demand Areas.

The factors In FIGURE 26 highlighted in 'Red' are the most influential (Economic; Markets), followed by next most influential 'Orange' (Approvals/Licensing; Processing; and Distribution) and then 'Yellow' (Resource; Social/Cultural and Governmental).

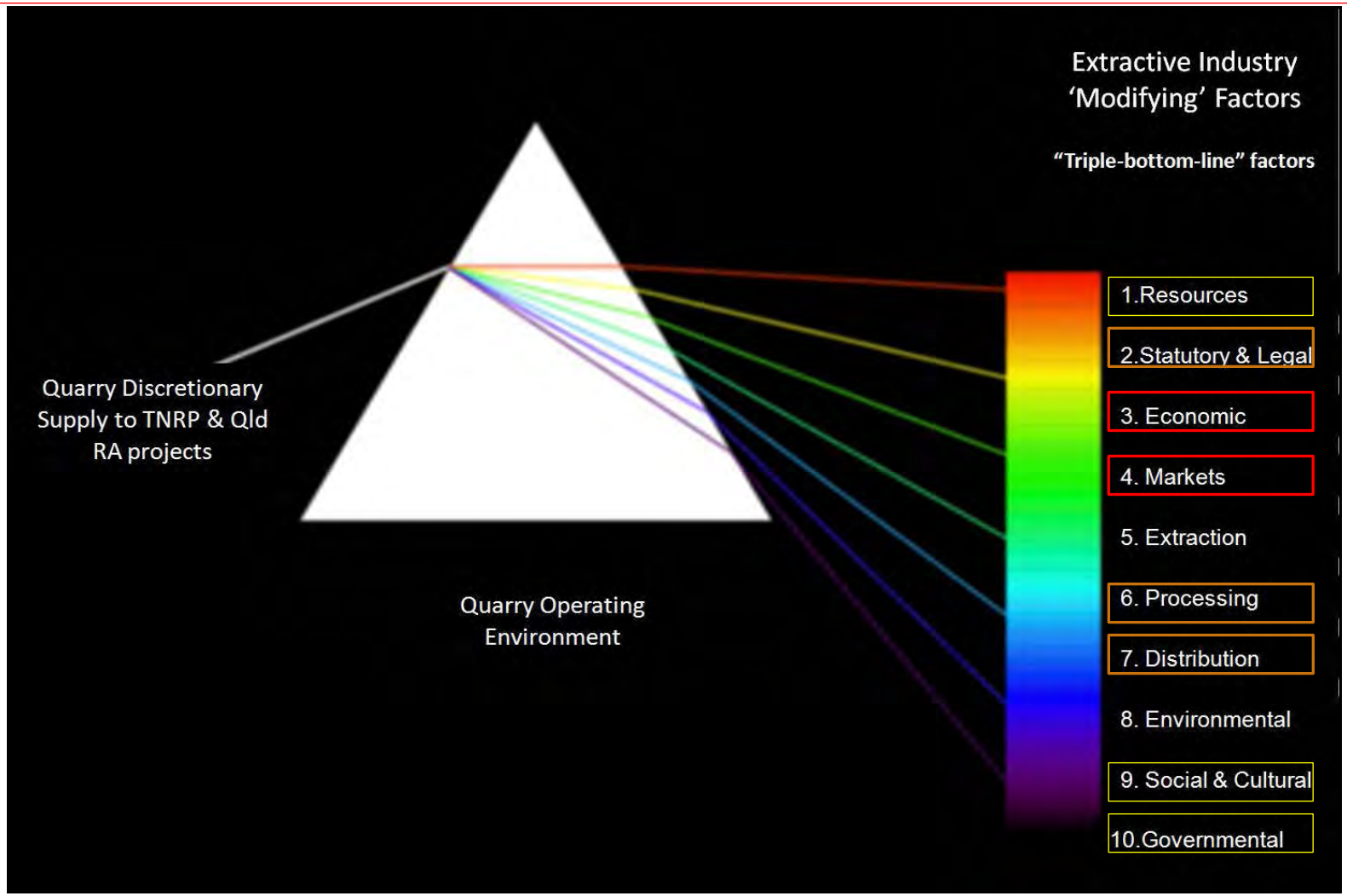


FIGURE 26: QUARRY ASSESSMENT FRAMEWORK – CONSTRAINTS TO DISCRETIONARY SUPPLY TO TNRP IN CRITICAL DEMAND AREAS

Source: Ecoroc (2011)

The factors that impact on discretionary supply capacity to TNRP interact and change. Monthly tonnages for production of Type 2.1 (2.2) roadbase have been estimated assuming constraints could be reasonably addressed or overcome. Similarly, the discretionary supply/production of aggregates has also been assessed, but the yield is low for a particular size fraction.

MWR Discretionary Supply
Constraints Addressed
Type 2.1 Roadbase
Jan 2012 – Scenario Only

Strategic Quarry	t/month
Mt Chelona	
Waitara	
Winchester Downs	
Blue Mountain	
Cedars	
Farleigh	
Hatfield	
Keatings	
Belmore (Jack's)	
Gordon's	
Longford Ck (Eden Lassie Ck)	
Byerwen	
Luxor (BHP)	
Prairie	
Foxdale Proserpine	
North Gregory	
Araluen	
Broadlea	
Fairfield, Clermont	
Moranbah South	
Waitara Braeside	
West Euri Creek (BQC)	
Total	**212,000**

Import from Other Regions	
Shepton Quarry	Fitzroy
After FY 2012	

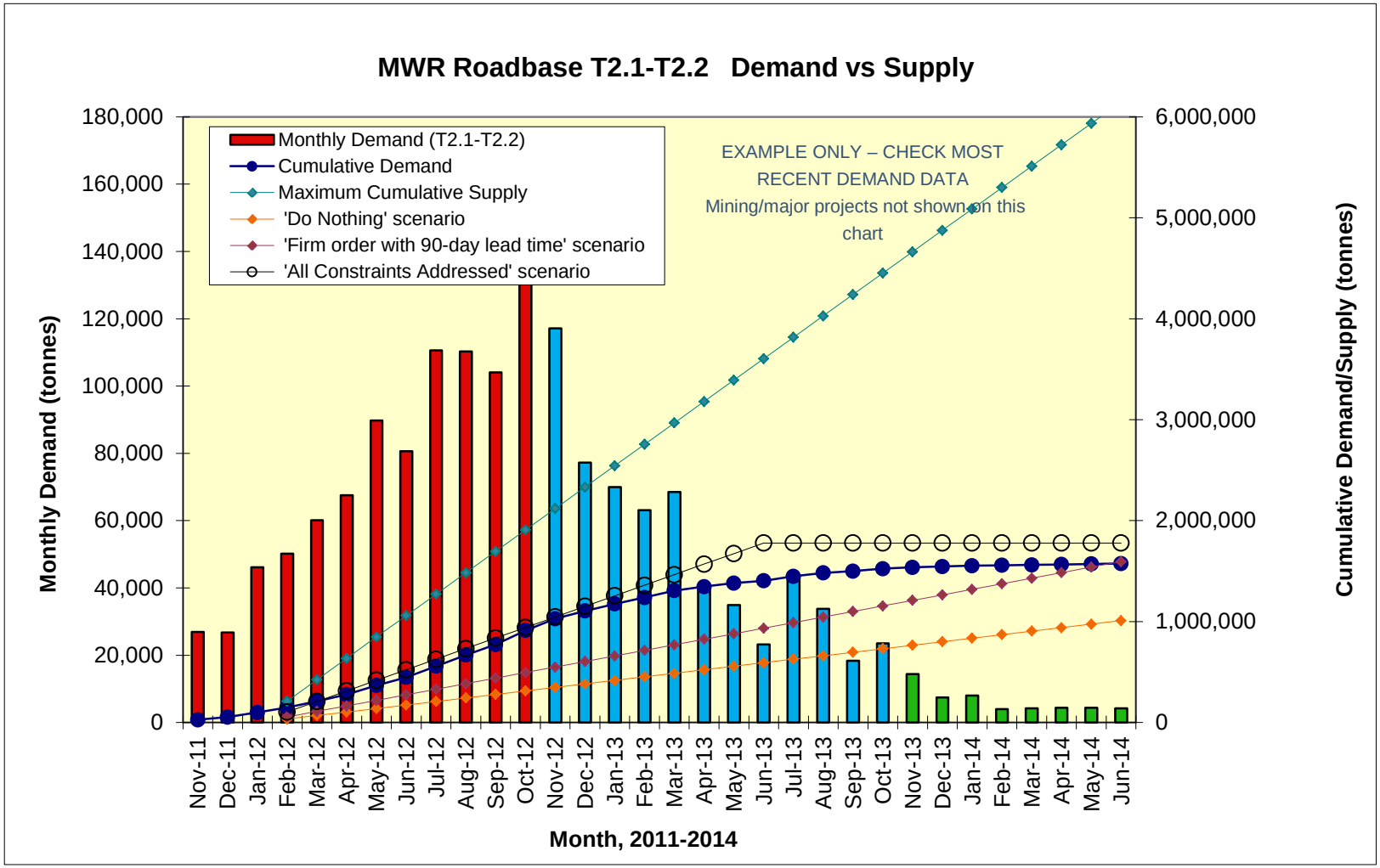


FIGURE 27: DEMAND V STRATEGIC QUARRIES' TNRP DISCRETIONARY SUPPLY FOR ROADBASE – MACKAY WHITSUNDAY REGION

Supply Side Constraints

There are five (5) dominant areas where supply side constraints are acting in the CDA's:

1. **Market Related** – sustained demand in some regions within CDA's means quarries could only supply if they have time to schedule and plan for the TNRP and Qld RA work.
2. **Truck Transport** – insufficient truck availability during peak demand, driver shortages, cartage rate increases.
3. **Approvals and Licensing** – inertia in DA process; exceedance of DERM ERA thresholds and IDAS trigger provisions; Wild Rivers declaration in Cooper Creek Basin; desperate need for ease of approval requirements for accommodation camps.
4. **Processing** – need for mobile crushing plants, operational labour and managers; shortage of pre-coat/CTB plants.
5. **Resources & Extraction** – Pit plans; blast logistics; product testing.

TABLE 6: SUMMARY OF SUPPLY-SIDE CONSTRAINTS FOR MACKAY WHITSUNDAY REGION

	Mackay / Whitsunday Region	Scenarios		
Constraints Area (Modifying Factor & no.)	**Constraints Description**	**Do Nothing**	**Advance Warning only**	**Constraints Addressed**
1. Resource & Extraction	Lack of pit planning (eg campaign sites); Quarry dev. plans (DEEDI OH&S requirement); blast logistics; O/B or stripping ratio; Variability of basalt quality (SMC etc; efficacy of specs.); Poor sampling/testing knowledge in CDA's amongst quarries and some labs	0.06	0.06	0.04
3/4. Market (Customer) & Competitive Choice	Lack of Forewarning/Communication - Quarries in CDA's with discretionary supply capacity need forewarning (eg 3 months advanced notice for TNRP supply); Little or no stock; Quarries say they can satisfy TNRP peak demand needs provided they are given adequate notice - eg Can add extra shift, schedule campaign crushing, help secure access to HR and C&S plant, arrange road haulage contractors etc	0.43	0.10	0.10
6. Processing	Reliance on mobile plant and campaign crushing (cf fixed plant); Capabilities of contract crushing firms (labour; skills; expertise); Most quarries don't have pre-coat plants	0.30	0.30	0.15
7. Truck Transport	Insufficient truck availability during peak demand; Problem reduces with production and delivery in advance of projects; Cartage price increases during term of supply contracts; Access for road trains; Haulage restrictions (eg Koumala Range); Driver experience / driver fatigue	0.27	0.27	0.20
2. Approvals & Licensing	Access to reserves; DERM ERA thresholds; DA's currently under assessment; DA's for accommodation camps; Extended hours of operation; Sale of quarry materials from mining leases; Access road/entrance requirements; Native title requirements and exemptions	0.40	0.40	0.16

These 'loss efficiency' factors have been applied (in the demand ~ supply modelling) to demonstrate the effect of addressing / partially overcoming constraints to discretionary supply in the CDA's.

Supply Side Constraints

The respective individual influences of the five (5) dominant supply-side constraint factors varies between quarries and across the CDA's.

But industry feedback has been unilaterally consistent in its message that advanced communication and notification of the requirement to supply to TNRP projects will be required, if discretionary supply is to match TNRP demand (eg Mackay /Whitsunday, Fitzroy, Far North, North West, South West and Darling Downs regions).

With forewarning, quarries can plan to mitigate some of the other constraints – For example by arranging for mobile crushing plant, adding a second shift, booking cartage contractors, installing a pre-coat plant, undertaking stripping of overburden, opening up a second face, extending stockpile areas (if room available), and recruiting labour.

For approvals and licensing, government assistance to overcome barriers will be necessary.

TABLE 7: SUMMARY OF SUPPLY-SIDE CONSTRAINTS FOR CRITICAL DEMAND AREAS (AS SHOWN)

		Relative Influence of Constraint		
Constraints Area (Modifying Factor & no.)	**Constraints Description**	**MWR**	**FNQ/NW**	**SW**
1. Resource & Extraction	Lack of pit planning (eg campaign sites); Quarry dev. plans (DEEDI OH&S requirement); blast logistics; O/B or stripping ratio; Variability of basalt quality (SMC etc; efficacy of specs.); Poor sampling/testing knowledge in CDA's amongst quarries without and labs and labs without quarries	10%	5%	10%
3/4. Market (Customer) and Competitive Choice	Lack of Forewarning/Communication - Quarries in CDA's with discretionary supply capacity need forewarning (eg 3 months advanced notice for TNRP supply); Little or no stock; Quarries say they can satisfy TNRP peak demand needs provided they are given adequate notice - eg Can add extra shift, schedule campaign crushing, help secure access to labour and C&S plant, arrange road haulage contractors; Schedule production properly	50%	60%	60%
6. Processing	Reliance on mobile plant & campaign crushing (cf fixed plant); Capabilities of contract crushing firms (labour; skills; expertise affecting plant availability); Most quarries don't have pre-coat plants	15%	5%	10%
7. Truck Transport	Insufficient truck availability during peak demand; Problem reduces with production and delivery in advance of projects; Cartage price increases during term of supply contracts; Access for road trains; Haulage restrictions; Driver experience / driver fatigue	10%	20%	15%
2. Approvals & Licensing	Access to reserves; DERM ERA thresholds; DA's currently under assessment; DA's for accommodation camps; Extended hours of operation; Sale of quarry materials from mining leases; Access road/entrance requirements; Native title requirements & exemptions	15%	5%	5%

Note, these factors are based on the assessment of overall constraints to supply from the Ecoroc project officers in the 'field' – their gut feel if you like. The data in Table 6 uses this information as an input – the factors in Table 6 are those used in the demand~supply analysis for CDA's.

FTR Discretionary Supply
Constraints Addressed

Type 2.1 Roadbase
Jan 2012: Scenario Only

Strategic Quarry	t/month
Pinnacle (Mt Curio)	
Tolmie Creek	
Orange Creek	
Sibelco Calliope	
Caves	
Marmor	
Midgee	
Peak Hill	
Nerimbera (Holcim)	
Bauhinia Downs (The Dump)	
Blackhill	
Mt Schofield (Willows)	
Shepton	
Kianga	
Stanwell	
Biloela (Rameel)	
Castle Creek	
Fairview Road	
Tableland Rd	
Red Rock ('Kullanda')	
Yarwun	
Ten Mile Pit	
Westwood	
Total	**270,000**

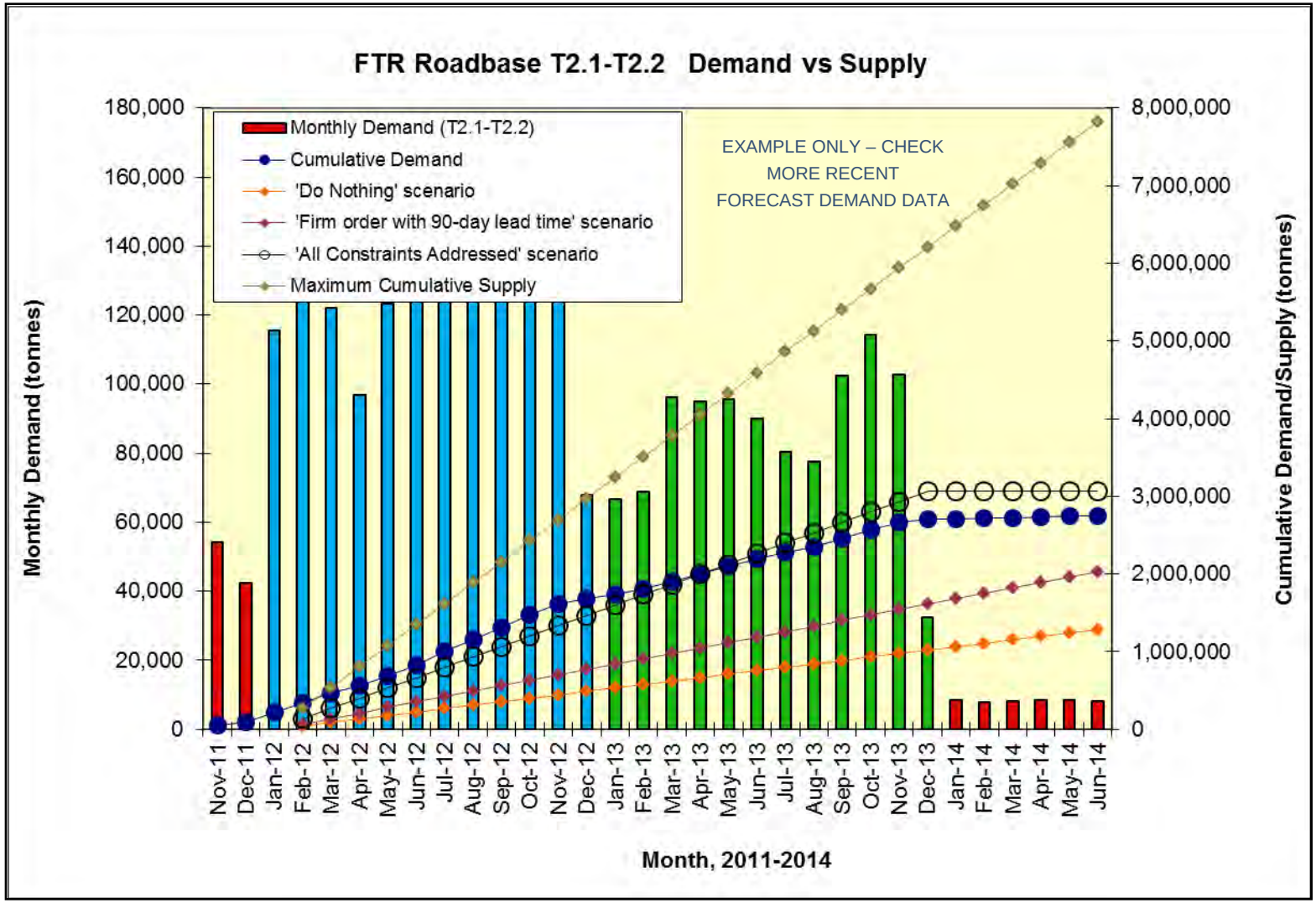


FIGURE 28: DEMAND V STRATEGIC QUARRIES' TNRP DISCRETIONARY SUPPLY FOR ROADBASE – FITZROY REGION

FTR Discretionary Supply
Constraints Addressed

Cover Aggregate
Jan 2012: Scenario Only

Strategic Quarry	t/month
Pinnacle (Mt Curio)	
Tolmie Creek	
Orange Creek	
Sibelco Calliope	
Caves	
Marmor	
Midgee	
Peak Hill	
Nerimbera (Holcim)	
Bauhinia Downs (The Dump)	
Blackhill	
Mt Schofield (Willows)	
Shepton	
Kianga	
Stanwell	
Biloela (Rameel)	
Castle Creek	
Fairview Road	
Tableland Rd	
Red Rock ('Kullanda')	
Yarwun	
Ten Mile Pit	
Westwood	
Total	**80,000**

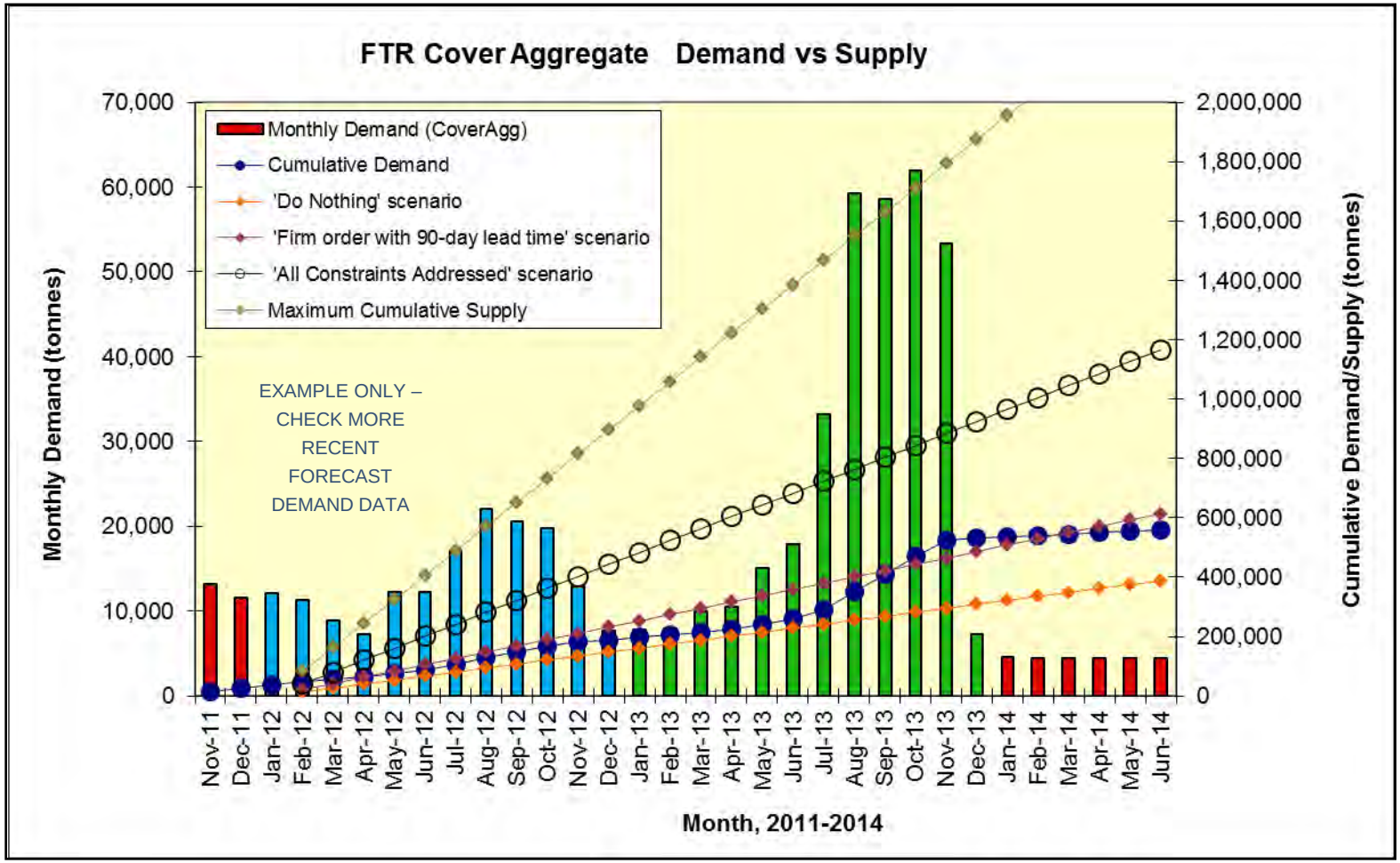


FIGURE 29: DEMAND V STRATEGIC QUARRIES' TNRP DISCRETIONARY SUPPLY FOR COVER AGGREGATE – FITZROY REGION

DDR Discretionary Supply
Constraints Addressed

Type 2.1 Roadbase
Jan 2012: Scenario Only

Strategic Quarry	t/month
Huston Rd Dalby	
Jimbour (Dalby)	
Glenvale (Holcim)	
Harlaxton	
Wellcamp Downs (Boral)	
Braeside (Wall's)	
Inglewood (Johnstone's)	
Braeside (Payne's)	
Leslie Dam (Hutchison)	
Malu (Boral)	
Bland Sands Basalt	
Antonio's (Captains Mtn)	
Yarraman	
Weringa	
Total	**60,000**

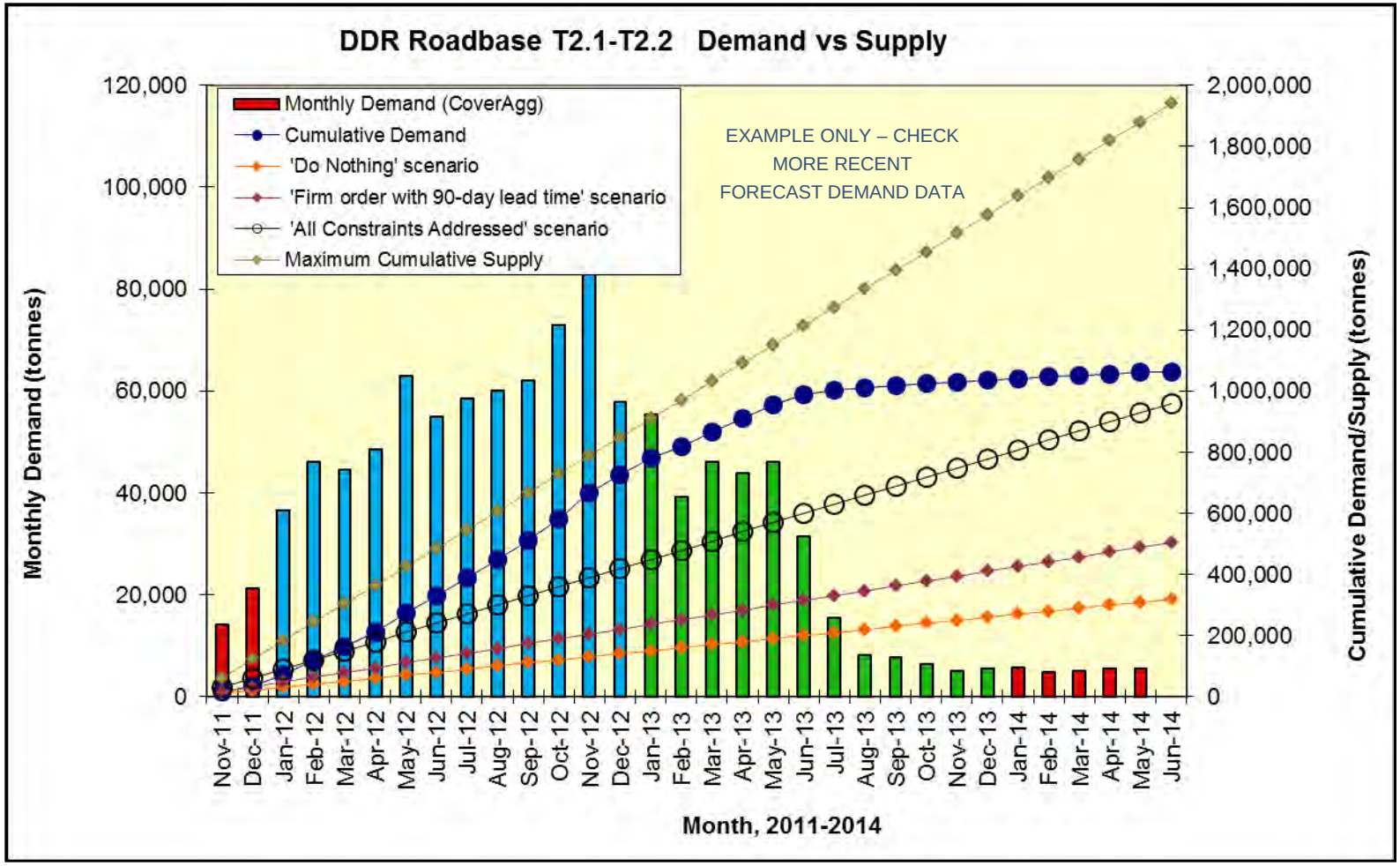


FIGURE 30: DEMAND V STRATEGIC QUARRIES' TNRP DISCRETIONARY SUPPLY FOR ROADBASE – DARLING DOWN REGION

SWR Discretionary Supply
Constraints Addressed

Cover Aggregate
Jan 2012: Scenario Only

Strategic Quarry	t/month
Warrians (Boral)	
Roma	
Amby	
Warrians ('Greenfield site)	
Amby ('Greenfield site')	
Total	**9,000**

NOTE:

DISCRETIONARY SUPPLY FROM STRATEGIC QUARRIES IS DYNAMIC AND CAN CHANGE

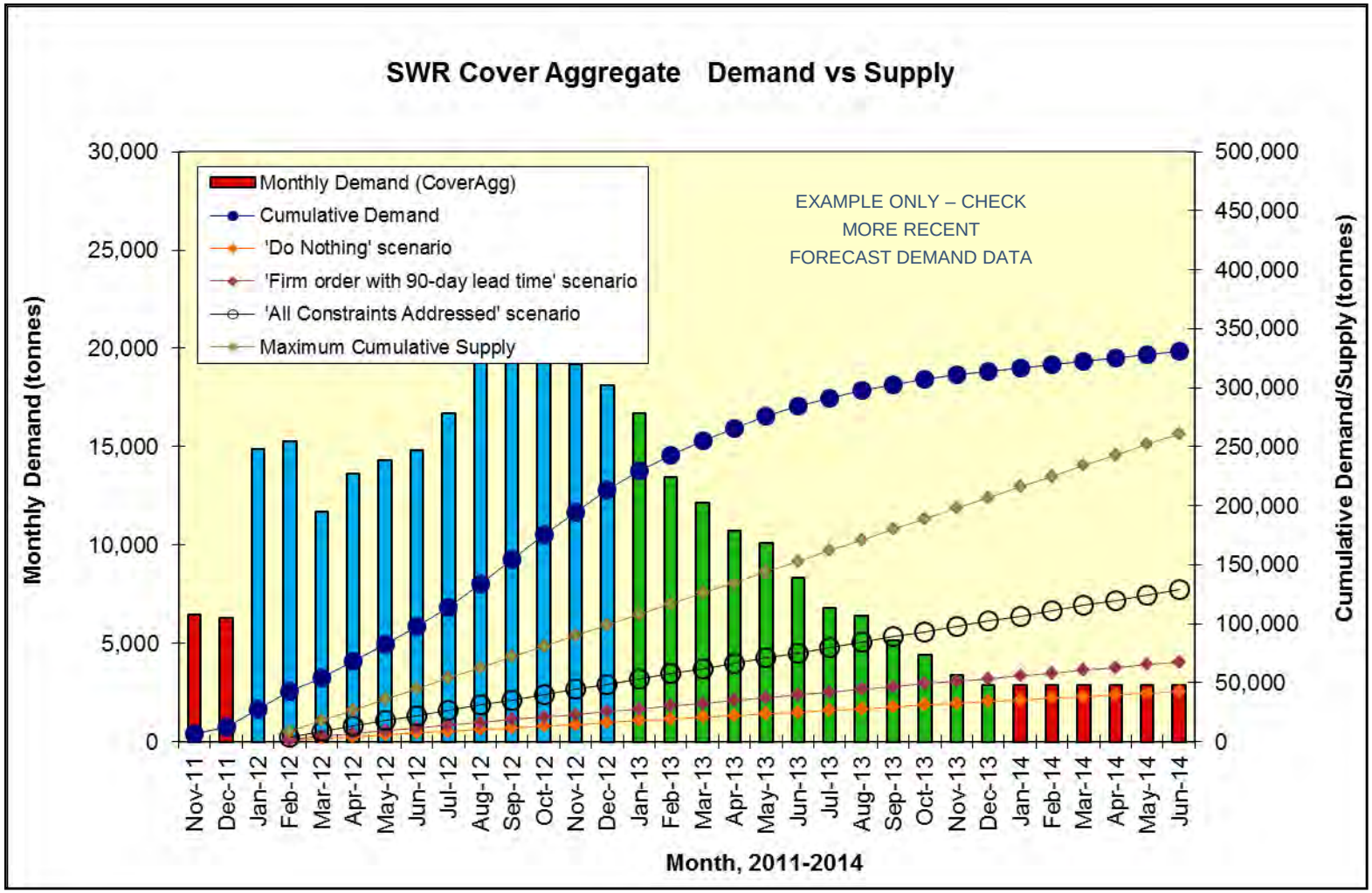


FIGURE 31: DEMAND V STRATEGIC QUARRIES' TNRP DISCRETIONARY SUPPLY FOR COVER AGGREGATE – SOUTH WEST REGION

Source: Orica website, 2012 – Loading explosives at a coal mine in Central Qld

CASE STUDY: ORICA – SUPPLY OF EXPLOSIVES IN CRITICAL DEMAND AREAS

Supply of explosives to the Qld quarrying sector is dominated by two firms - Orica 40% and Maxam 60%. If supply to the construction industry is added, then market share is about 50/50. Supply of explosives is a potential constraint during TNRP and Qld RA peak demand.

Orica expect demand from the construction sector in the CDA's to rise by 50% over the next 12 months. From Orica's perspective, the supply of drilling rigs shouldn't be a constraint, but the firms are small and some can get into financial difficulty – they can struggle to fund their growth and Orica often find they have to 'nurse' drilling firms that owe them money for explosives previously supplied. Orica also find that a surprising number of quarries have little or poor quarry development planning and this can create significant productivity problems for Orica – Eg they are told by the quarry that the next shot will be ready in 2 days and will take 8 tonnes of explosives. When Orica arrive, the shot is still not ready, it can only take 5 tonnes, and the explosives truck can't safely drive to the blast site because no-one thought about access. Orica believes there needs to be better training and understanding by quarry operators of what is needed by drill and blast contractors (such as forward planning, site preparation, provision of safe access etc).

A significant additional problem is there is no available accommodation for the Orica people (and other subcontractors that visit CDA's). Large companies pre-book all hotel rooms and so after a long day handling explosives, Orica personnel may have to drive several hours back to their nearest accommodation.

Orica have a good presence in Central Qld – they are able to re-load fairly quickly in the coal mine provinces – they can use existing facilities at mine sites (take extra emulsion, then top up with prill at mine sites) to service campaign blasting programs – eg at Roma Amby, they can produce 120,000 tonnes of broken rock over 5 days using 40-60t of product.

To obtain people, Orica recruit, train, induct people themselves mainly from the regions and they offer project duration contracts. It costs about $15-20k to induct and train a new employee + an allowance for a demobilisation fee (after the project, there is not necessarily continuity of work so Orica pay out their local workers).

The biggest constraint aside from labour is the availability of explosives trucks (MPU's or mobile processing units). These are made in Australia but there is a 6-9 month lead time to make a unit. For TNRP demand of say 15Mt of shot rock to produce roadbase and aggregates, at 2.7 tonnes/m3 and 0.6 kg/m3 powder factor, about 3333 tonnes of explosives will be consumed. A productive MPU can do about 1000 tonnes per year, so the TNRP component alone would require about 3 MPU's. If Qld RA (LGA) needs are added in, then an additional 4-5 MPU's are probably needed over the next 2.5 years. But then what? MPU's have a useful life of say 7-8 years.

Orica also believe that availability and demands on truck drivers are real issues. At an average age of 53, and with longer haul distances, and with fatigue (OH&S) laws in effect, longer haul sites might only get to deliver one load per day from quarry to project – this could considerably delay TNRP projects unless more drivers and trucks can be found.

Source: Interview notes with Rob Sloman, Orica - ABM Quarries and Construction, Queensland

BALANCING DEMAND WITH SUPPLY

The LHS diagram shows the total tonnes (Total TNRP demand) for cover aggregate (red) and roadbase (green) by DTMR Region, for the eight (8) CDA's over the period 2012 and 2013.

The RHS diagram shows the discretionary supply capacity on a monthly basis PROVIDED supply side constraints and bottlenecks can be satisfactorily addressed and overcome, in advance of peak demand.

Note that the RHS discretionary supply chart represents a 'reasonable case' scenario only if constraints can be overcome by prompt action.

Note also that these regional summaries do not identify supply-demand variations at Local Government Area level, or within LGA's. Such iterations can be explored using the TNRP All Quarries database and MapInfo, as required.

TNRP demand in MWR and FTR is amongst the highest of the CDA's. However extractive resources are available if approvals, timing, licensing, labour and processing constraints can be addressed.

New quarries &/or multiple plants at existing sites are likely to be necessary to address peak TNRP demand in SWR, CWR and DDR

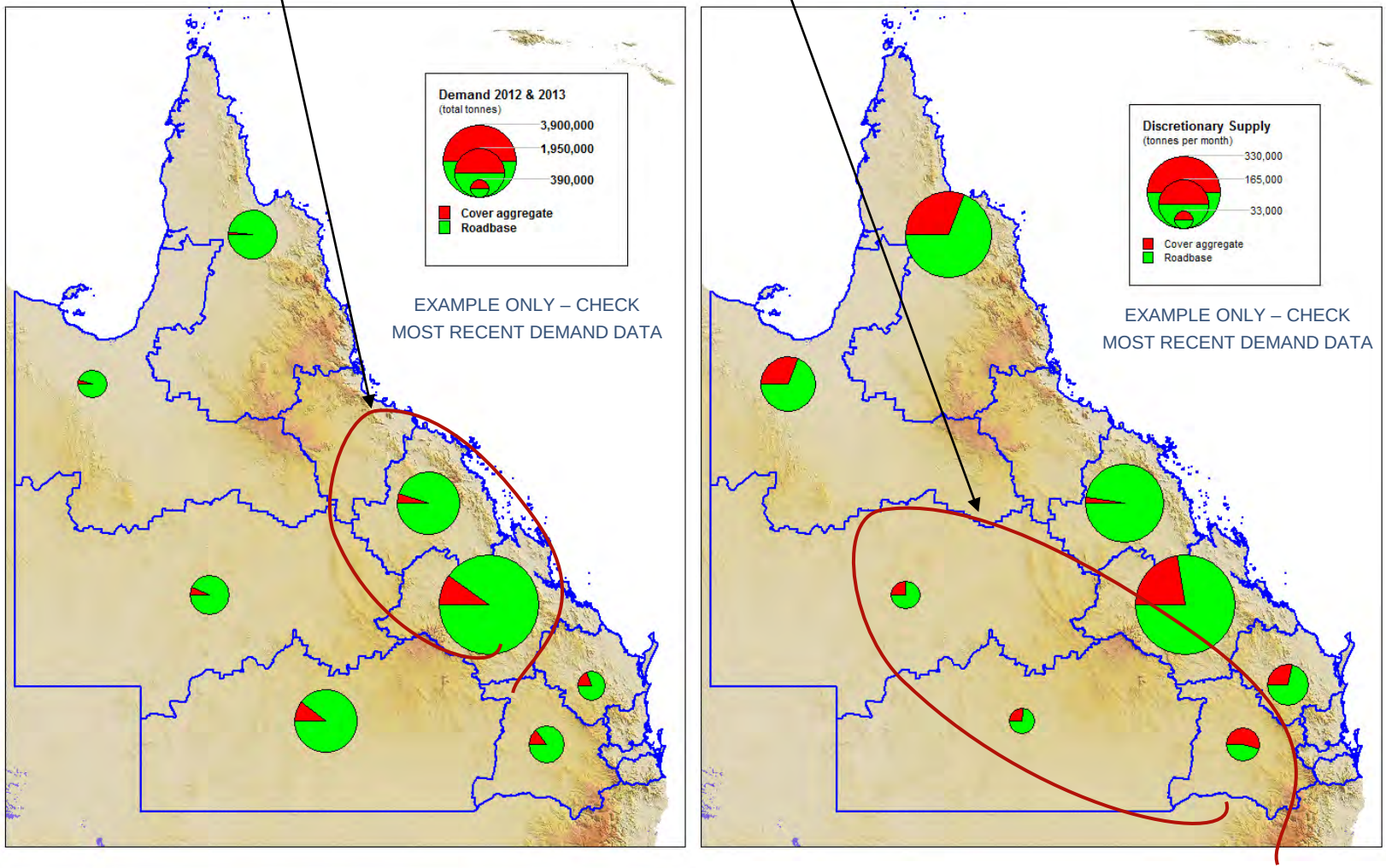


FIGURE 32: TNRP TOTAL QUARRY MATERIAL DEMAND (2012-2013) AND MONTHLY DISCRETIONARY SUPPLY (CONSTRAINTS ADDRESSED) FOR THE EIGHT (8) CRITICAL DEMAND AREAS

There are numerous options and iterations that can be generated using MapInfo outputs from the TNRP All Quarries database.

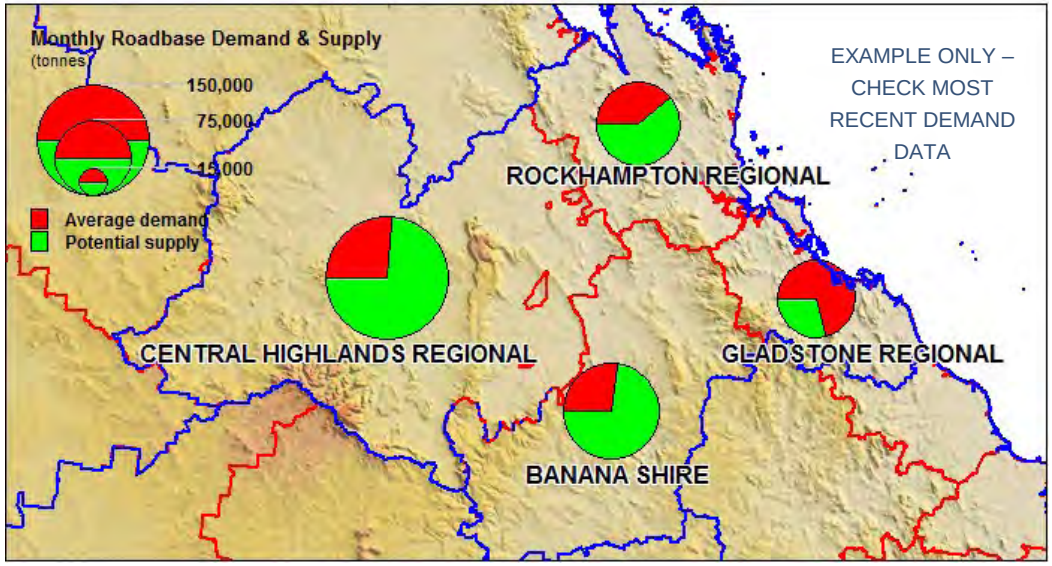
FIGURES 33 and 34 are illustrations only using the Fitzroy region as an example, of the different ways demand and supply indicators can be generated from the database.

Note that these data are shown for illustrative purposes only and may have changed.

FIGURE 33: FITZROY REGION – AVERAGE MONTHLY DEMAND FOR QUARRY MATERIALS AND POTENTIAL TNRP SUPPLY (BY LGA)

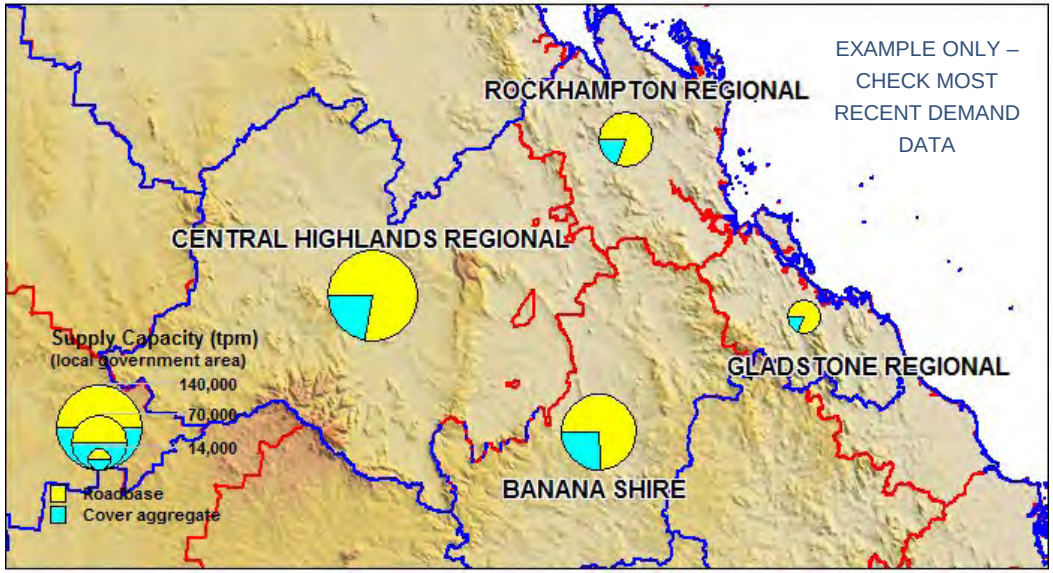
LGA	ROADBASE	COVER AGGREGATE
Rockhampton Regional	702,069	94,413
Central Highlands Regional	916,405	240,148
Gladstone Regional	1,156,200	47,736
Banana Shire	70,000	21,941
TOTALS	3,414,759	404,238

TABLE 8 : FITZROY REGION – TNRP FORECAST 2012-2013



FITZROY REGION: AVERAGE MONTHLY DEMAND & POTENTIAL SUPPLY BY LGA 2012-13

FIGURE 34: FITZROY REGION –AVERAGE MONTHLY DISCRETIONARY SUPPLY BY PRODUCT TYPE AND LGA



FITZROY REGION: MONTHLY DISCRETIONARY SUPPLY BY LGA (TONNES PER MONTH) (2012-2013)

Chesalon Quarry near Alpha operated by Crushing Industries Australia is the only known hard rock quarry site in the Central West Region. It is one of 13 sites CIA use for contract crushing.

But the development of coal mines in the Galilee Basin has triggered investigations for new quarry sites.

Two such sites are at Frankfield and Surbiton – both are still the subject of negotiations with landowners, leaseholders and mining companies.

These quarries are being positioned to be suppliers for rail development and new mine development in the Galilee Basin.

Nevertheless, if they received approval in time, and (if on a mining lease) were able to supply off-site, then they could assist in TNRP supply to both the Central West and Isaac Regional Council areas.

But for most of the Central West, silcrete and residual gravel won from 'borrow pits are the critical supply sources.

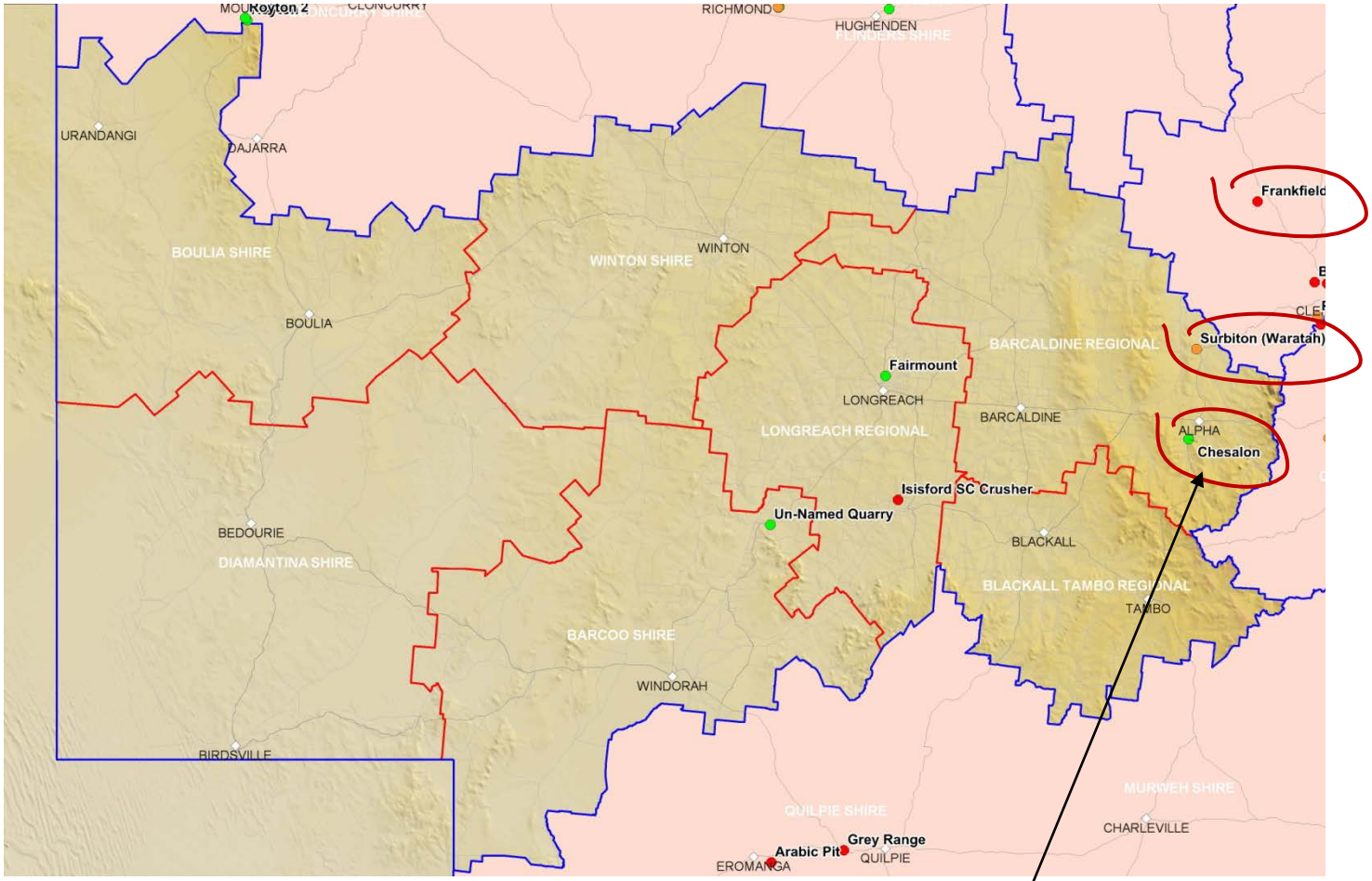


FIGURE 35: CENTRAL WEST REGION – LOCATION OF ACTIVE AND INACTIVE QUARRIES

Chesalon Quarry is a Strategic Quarry and the only known hard rock source for the Central West. The constraints are largely geological. New quarry sites in igneous rocks in the Alpha/Galilee Basin region are proposed at Frankfield and Surbiton, but negotiations on terms of tenure are yet to be finalised and the sites have no development approvals.

The Cooper Creek Wild River Declaration took place in Dec 2011.

For the Central West LGA's, 223 known gravel pits out of a total of 232 are within the Wild Rivers Area (or 96%).

Figure 36 shows the location of the gravel pits identified in a current SKM study of environmental issues associated with roadbase/gravel supply sources for DTMR for the Central West Region.

Until Dec 2011, a Gravel (or Borrow) Pit approval could take a month and was code assessable, provided the resource could be worked under a DERM Code of Compliance and the gravel pit was not within a Wild Rivers Declared Area.

There is concern that without amendment of the DERM extractive code to allow code assessable gravel extraction from a gravel pit, approvals could take 6-9 months and road reconstruction works in Western Queensland could be delayed.

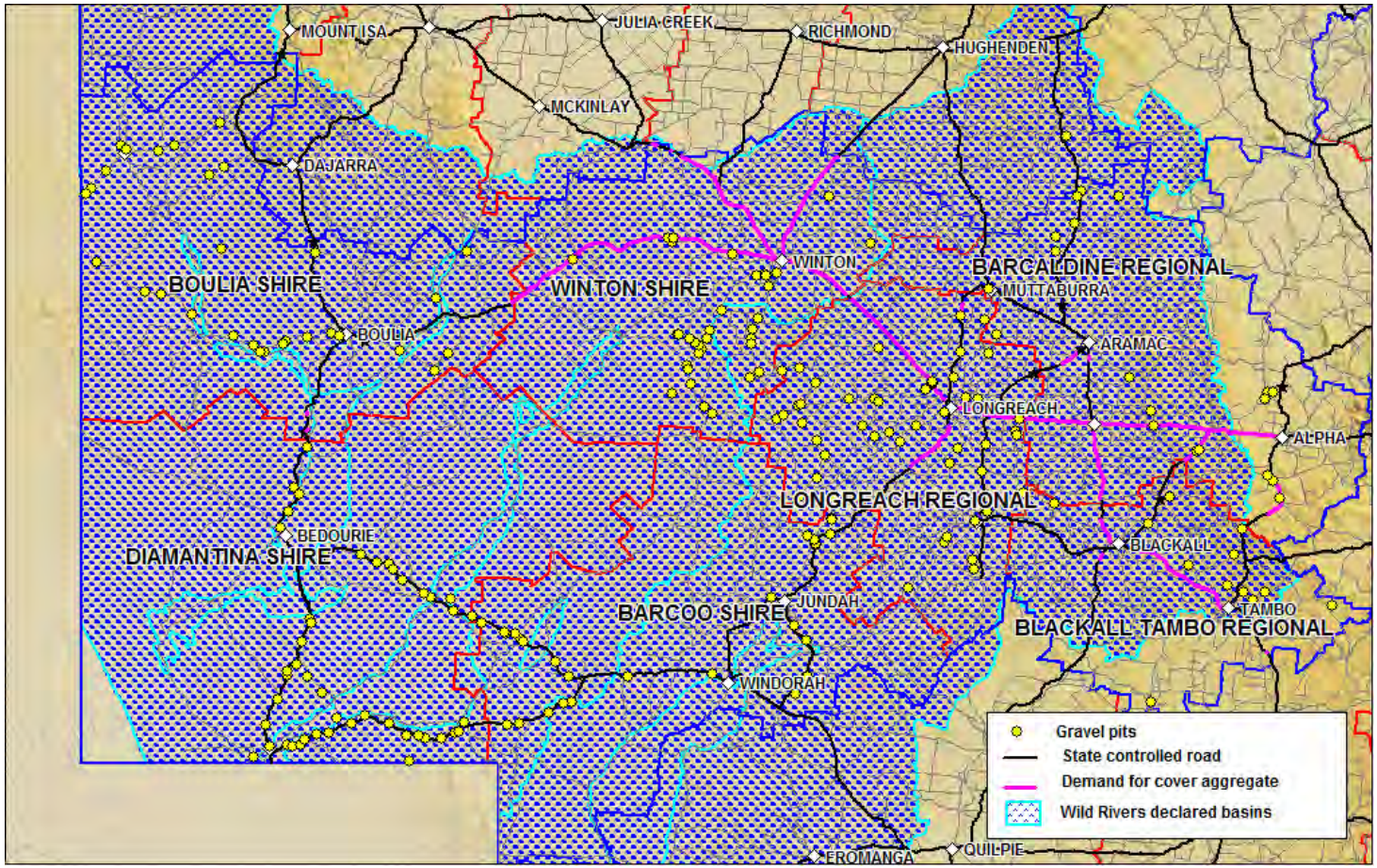


FIGURE 36: CENTRAL WEST REGION – BORROW (GRAVEL) PIT LOCATION AND COOPER BASIN WILD RIVER DECLARED AREA

The (geological) shortage of hard rock in Western Qld has necessitated the use of local materials for local road construction materials. These materials include Tertiary duricrust surfaces (silcrete and ferricrete), lateritised alluvium from linear ridges of ancient river beds and residual silcretes/shaley limestones such as 'Gidgee' or 'Kopi' stone. (Source: Qld Geology", Chapter 12: Engineering Geology, in prep, contributor Kyle Waye).

From a total of 232 borrow pits in the shires of the Central West region 223 lie within the Wild Rivers declared area for the Cooper Basin. A further 20 borrow pits could be similarly affected in the South West Region.

The Cooper Creek Wild River Declaration 2011 places additional constraints on extractive industry – likely making development applications more complex, more time-consuming and more costly.

Prior to the legislation, the environmental licensing to extract from a gravel deposit as a source of road material, was code assessable provided the activity was low impact, under 100ktpa and NOT in a Wild Rivers Area etc.

Under the new legislation, gravel pits can't comply with the DERM Code for extractive industry (ERA 16).

The applicant must also demonstrate that there are no other suitable sources of material available; and an MCU for an extractive industry becomes a prohibited use in "waters" in a wild river area, unless an allocation notice is issued.

It is not clear what all the terms mean insofar as they relate to extractive industry. The changes create more restrictions, and a more complex regulatory regime (for even low impact extractive industry) that could add 6 to 9 months for an approval to source gravels for a road project.

COOPER CREEK BASIN WILD RIVER DECLARATION 2011

Legislation - Chapter 3 Taking of natural resources

9. Quarry material allocations
(1) This section applies to applications for the allocation of quarry material in the wild river area under the *Water Act 2000*.

(2) For an application under the *Water Act 2000*, section 280, if any part of the application relates to the wild river area, the application is taken not to have been made unless the quarry material is to be used in the wild river area.

(3) If any part of the application relates to a wild river area, the application will not be granted unless it can be shown that there is no other suitable source of material that is —
(a) outside a watercourse; and

(b) within a reasonable distance from where the quarry material will be used.

Legislation s57. Environmentally relevant activities (prohibited activities)

(1) The following development is prohibited under the *Sustainable Planning Act 2009*, Schedule 1, item 9—
(a) an environmentally relevant activity (ERA), or a material change of use of premises for an ERA; and
(b) assessable development prescribed under section 232(1) of the *Sustainable Planning Act 2009*; and
(c) to the extent it involves development in waters in a wild river area that is for an extraction ERA, other than if the development application is accompanied by an allocation notice.

EXTRACT FROM EXISTING DERM CODE FOR CODE ASSESSMENT OF CERTAIN ERA 16 ACTIVITIES

DERM Code of environmental compliance for certain aspects* of extractive and screening activities
(ERA 16) Version 6 Code Assessable Criteria

The activity applies to the extraction and screening of material for the construction or maintenance of rail transport infrastructure and roads.

The quantity of material extracted or screened at any one site is between 5000 and 100,000 tonnes per year and the maximum area of disturbance is 1.5 hectares.

There is no intentional or negligent release of contaminants to waters from the activity.

4. The activity will not be carried out in:
a protected area; or in a Wild River Area as defined in the *Wild Rivers Act 2005*.

The activity does not include the use of explosives.
The activity occurs in daylight hours and between the hours of 6am and 6pm. The activity does not occur within 1 kilometre of a sensitive place. The activity does not occur within 100 metres of any watercourse, wetland or spring.

The suitability of other resources and what constitutes a reasonable distance are not defined – this adds uncertainty and complexity to any application for removal of gravel materials.

Existing low impact extractive industry applications can no longer comply with DERM's code because the gravel (borrow) pits are in the Wild River Area. Presumably (though it is not clear), this suggests a more complex approval process adding considerable uncertainty, time delays and costs.

OVERCOMING SHORTFALLS AND RESTORING THE DEMAND SUPPLY BALANCE in CDA's

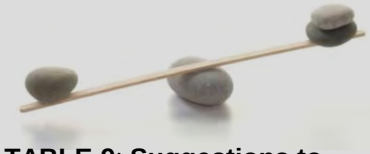


TABLE 9: **Suggestions to Mitigate Supply-Side Constraints**, provides suggestions to address, mitigate or overcome quarry material supply-side constraints and thus increase discretionary supply to TNRP, Q Trip and Qld RA projects.

An overall estimate of the relative impact of the constraint on the discretionary supply from Strategic Quarries in CDA's is shown in the third column.

The most effective initiative to improve discretionary supply is to ensure advanced notice/sufficient warning is provided to quarries, for the supply of roadbase and pre coat aggregate materials.

Other crucial productivity initiatives include streamlining approvals & licensing, providing stockpiling options, basic training on products and managing truck logistics.

TABLE 9: SUGGESTIONS TO MITIGATE SUPPLY-SIDE CONSTRAINTS

Constraints Area Modifying Factors	Constraints Description	Relative Impact	Suggestions & Recommendations to Mitigate Constraints
Market/ Customer/ Competitive Choice	Lack of Forewarning/Communication - Quarries in CDA's with discretionary supply capacity need forewarning & 1-3 months notice for TNRP supply; Little or no stock; Quarries say they can satisfy TNRP peak demand provided they are given adequate notice - eg Can add extra shift, schedule campaign crushing, help secure access to labour and C&S plant, arrange road haulage contractors	55%	• Establish permanent communication channel(s) with extractive industry (eg website on TNRP/Qld RA) on locality and timing of need for quarry materials • Provide quarries with forewarning of need to supply • Regularly update discretionary supply capabilities of Strategic Quarries in CDA's • Allow product supply in crucial areas into project stockpile before project commencement
Truck Transport	Insufficient truck availability during peak demand; Problem reduces with production and delivery in advance of projects; Cartage price increases during term of supply contracts; Access for road trains; Haulage restrictions; Driver experience / driver fatigue; Larger loaders needed for peak supply (eg Multiple Road Trains)	15%	• Can reduce by providing sufficient notice to quarries so they can organise/recruit/schedule trucking prior to project; but is fairly intractable • Check Strategic Quarries for Road Train access • Trucks from interstate program?
Processing	Reliance on mobile plant & campaign crushing (cf fixed plant); Capabilities of contract crushing firms (labour; skills; expertise); Most quarries don't have pre-coat plants	10%	• Engage with contract crushing firms to assist in mitigating relevant supply constraints • Suggest road contractors have pre-coat agg. contingencies
Approvals & Licensing	Access to reserves; DERM ERA thresholds; DA's currently under assessment; DA's for accommodation camps; Extended hours of operation; Sales of quarry materials from mining leases; Access road/entrance requirements; Native title requirements & exemptions	8%	• Accelerate DA approval process for Strategic Quarries and Quarries of Interest • Consider rolling average for DERM ERA thresholds; allow code compliance for strategic quarries • Simplify/fast track small accommodation camps
Resource & Extraction	Lack of pit planning (eg campaign sites); Quarry dev. plans (DEEDI OH&S requirement); blast logistics; O/B or stripping ratio; Variability of basalt quality (SMC etc; efficacy of specs.); Poor sampling/testing knowledge in CDA's amongst quarries and some labs	8%	• Update Strategic Quarries List • Investigate Quarries of Interest • 'Activate' dormant strategic quarries • Consider case by case basis for marginal quarry products from Strategic Quarries • Initiate basic sampling & testing courses

This chart provides an indication of ease of implementation of actions to overcome supply-side constraints and their effectiveness in increasing discretionary supply.

EASE OF IMPLEMENTATION v INCREASE IN DISCRETIONARY SUPPLY

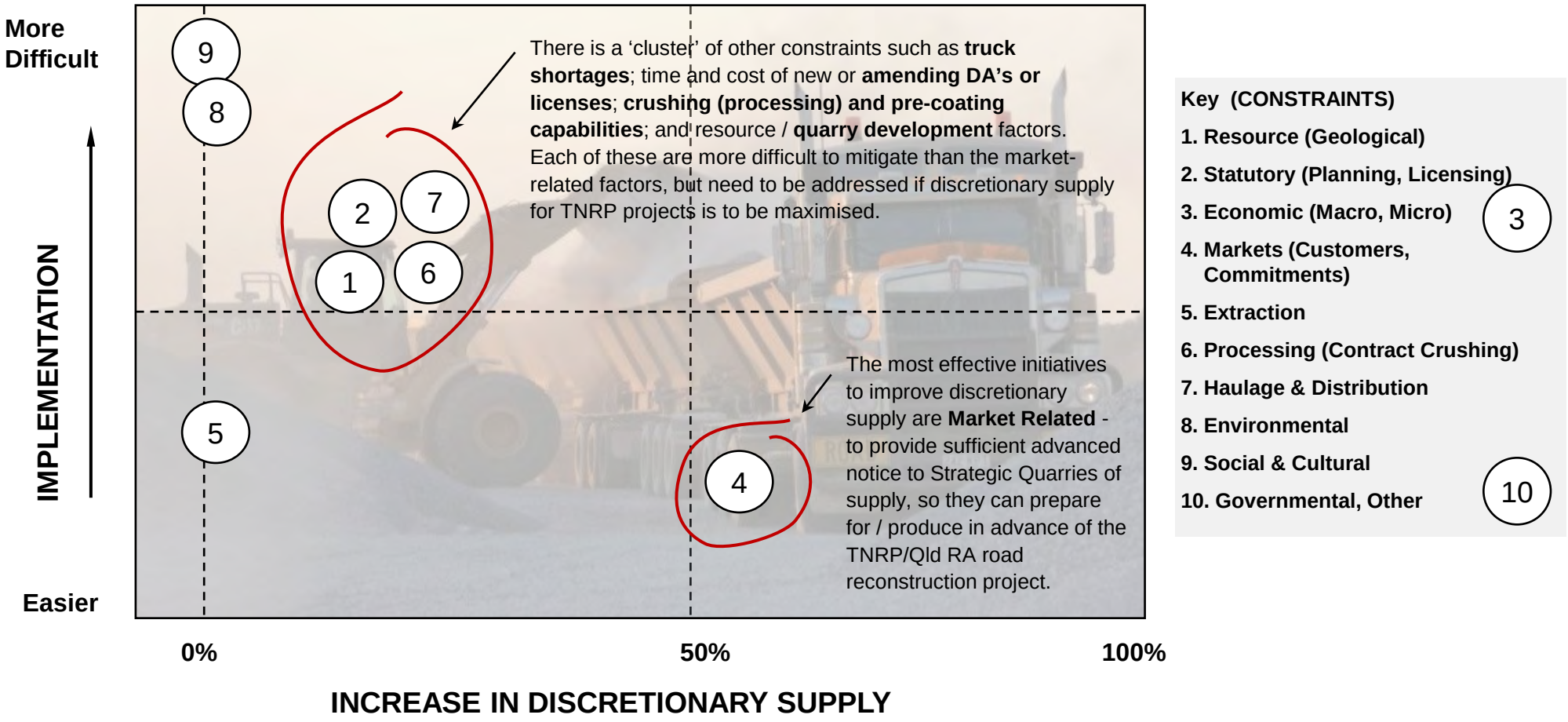


FIGURE 37: HARD ROCK QUARRY PRODUCT SUPPLY CONSTRAINTS in CDA's - EASE OF IMPLEMENTATION V INCREASE IN DISCRETIONARY SUPPLY FOR STRATEGIC QUARRIES