Mount Monster rhyolite deposit near Keith — potential resumption of quarrying

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Geological Survey Branch

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Government of South Australia
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Mount Monster rhyolite deposit near Keith — potential resumption of quarrying

J.K. Hough and R.S. Robertson

ABSTRACT

Ordovician porphyritic rhyolite was quarried for road sealing aggregate and rail ballast from two quarries at Mount Monster, 12 km south of Keith, between 1955 and 1976. Total recorded production was 548 000 tonnes. MC 3631 was recently pegged over the larger northern quarry on Section 499, Hundred of Stirling (Water and Stone Reserve No. 1). The smaller quarry, 150 m to the south, is covered by Private Mine 173. PM 173 also covers and predates part of the Mount Monster Conservation Park to the south. The Park is proclaimed as a single proclamation park. Plans to resume quarrying at both sites are contentious due to proximity to the Park, plans by the Department of Environment and Heritage (DEH) to incorporate both areas into the Park, the presence of native vegetation including threatened species and some local opposition to any resumption of quarrying.

Assessment of previous information, including material testing data, confirms that the Mount Monster quarry sites have excellent geological potential to supply high quality aggregate for the upper South-East region. Investigations using existing regional geological mapping and field inspections suggest that the fine-grained volcanic rocks at Mount Monster and Papineau Rocks are by far the best potential aggregate sources in the region having very good durability and skid resistance properties. However Papineau Rocks is much less suitably located to supply the Bordertown–Keith–Tailem Bend region being about 80 km by road south of Mount Monster. Ordovician granite outcrops are relatively common in the region but their coarse-grained nature makes them unsuitable for use as road sealing aggregates.

Resources at the northern quarry site are estimated at 600 000 tonnes or 1 000 000 tonnes for a deeper final quarry design. Resources for a larger development incorporating the southern quarry have not been estimated but are likely to be considerably larger. Overburden depths between the existing quarries would need to be established to estimate this resource.

INTRODUCTION

The two Mount Monster rhyolite quarries, 12 km south of Keith, were a significant source of road sealing aggregate and rail ballast from 1955 to 1976. The northern quarry site has recently been repegged as a Mineral Claim and the claim holders are also planning to quarry the southern quarry site (PM 173) to supply high-quality aggregate to the upper South-East region. The proposed operation is contentious due to proximity to the Mount Monster Conservation Park, plans by DEH to incorporate both areas into the Park, the presence of native vegetation including threatened species and some local opposition to any resumption of quarrying.

The purpose of this report is to investigate the geology and resources at Mount Monster and at other sites of possible similar rock in the upper South-East region to assist in an assessment of the strategic importance of the site. Previous geological and resource investigations are summarised. In addition other matters relevant to potential renewal of quarrying at the site including tenement and land ownership history and native vegetation are summarised.

Johns (1951) first investigated outcrop of Ordovician Delamerian porphyritic rhyolite at Mount Monster as a source of rail ballast and road sealing aggregate. Quarry Industries and other companies undertook quarrying on a campaign basis from 1955 to 1976. The Mount Monster and

Papineau Rocks quarry sites were investigated by Pain and Robertson (1981) and Rosier and Pain (1982) respectively and the two summarised in Pain et al. (1984). Pain and Robertson (1981) includes as an Appendix a report by M.F. Stadter on results of pump testing on water in the northern quarry at Mount Monster. The Conservation Park and quarry area (Section 478, 480, 499, Allotment 11) is listed as a Geological Monument as recommended by Toteff (1979).

The Mount Monster rhyolite is one of only two currently known sources of rock for road sealing aggregate in the upper South-East (the other being Papineau Rocks). Rogers (1980) considered the rhyolite at Mount Monster to be one of the most important sources of road sealing aggregate and rail ballast because of its superior geotechnical qualities, being finer grained and more durable than other acid igneous rocks within the region.

Work undertaken for this report includes a differential GPS survey of the two quarry areas on MC 3631 (Water Stone Reserve No. 1, northern quarry) and part of Private Mine 173 (Allotment 11, southern quarry) to relate the quarry survey undertaken for the 1981 report to the current map grid and to check elevation data. The resource estimate for the northern quarry site has been revised from the 1981 figure to take into account the unavailability of material at the eastern end of the quarry due to the presence of the endangered species Monarto Mintbush. Additional resources available with a deeper quarry design have also been estimated.

To investigate possible alternatives to Mount Monster geological field reconnaissance of other acid volcanic and granite basement outcrops within the upper South-East region was undertaken. Areas visited include the Mount Monster and Papineau Rocks (EML 6168) quarry sites, the Mount Monster outcrop area south of the Conservation Park, several granite outcrops near Mount Monster and other outcrops of Ordovician volcanic rock between Keith and Kingston.

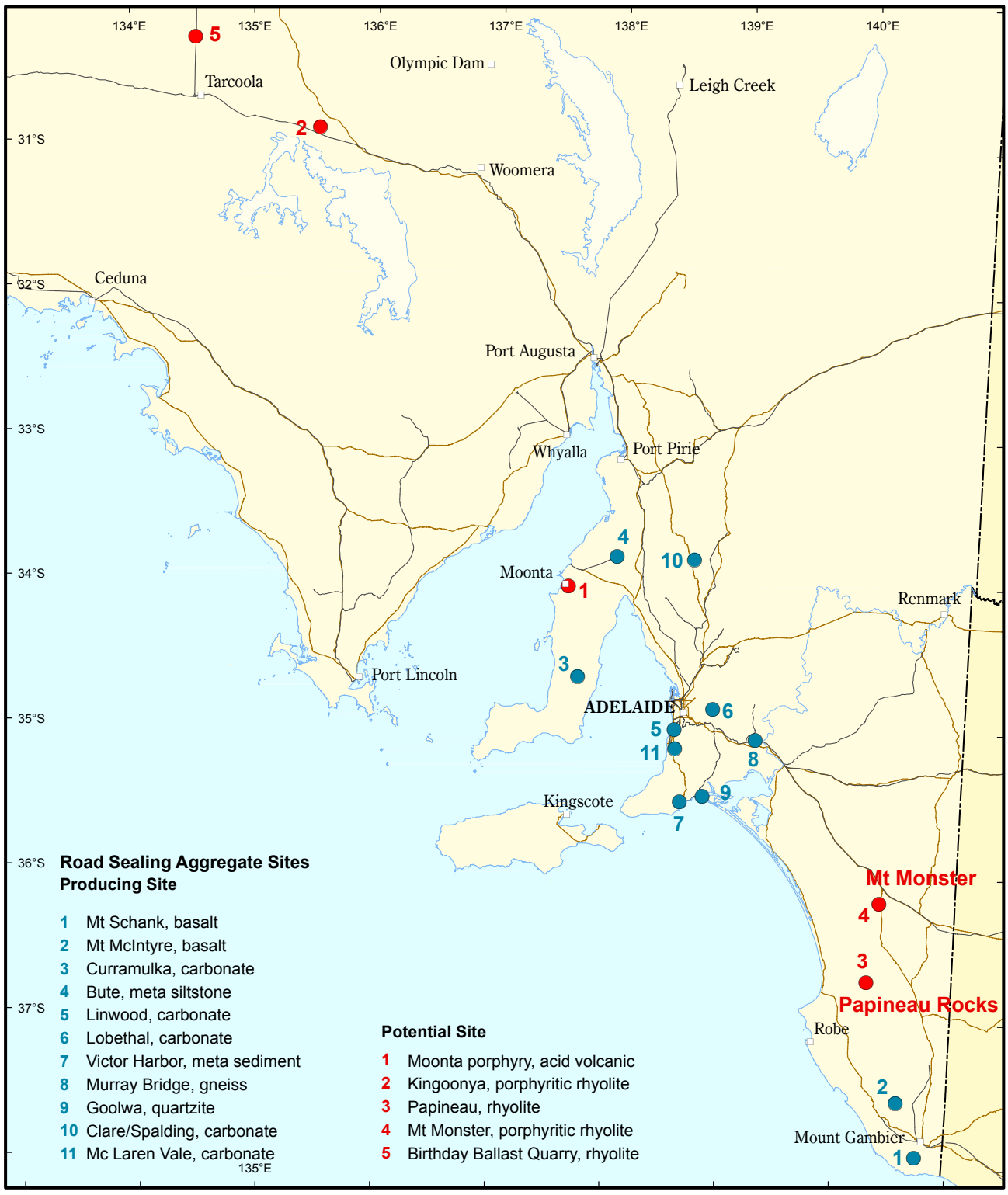
ROAD SEALING AGGREGATE IN SOUTH AUSTRALIA

South Australia produces approximately one million tonnes of rock annually for use as road sealing aggregate. All road sealing aggregate used in the Adelaide metropolitan area is ‘carbonate’ rock (dolomite, limestone, calcareous siltstone, dolomitic siltstone and metasiltstone) from Adelaidean and Cambrian age rocks. ‘Carbonate’ rock types bond much more readily with bitumen than quartzitic rocks which are the other main rock type quarried in the region. Variable percentages of silica within the carbonate bearing rocks provides abrasion and skid resistance. In other parts of the State a variety of rock types is used but fine grained volcanic rock (rhyolite, rhyodacite, basalt) is preferred where available.

Significant current sources of road sealing aggregate are listed in Table 1 (see also Fig. 1).

Table 1. Current sources of road sealing aggregate in South Australia

Operator	Location	Rock
Mount Schank (Gambier Earth Movers)	Mount Schank	Basalt
Boral Resources	Mount McIntyre	Basalt
Hanson Pty Ltd	Curramulka	Carbonate
Kruse Quarries	Waterloo	Meta-siltstone
Lucas Earthmovers	Curramulka	Carbonate
Boral Resources	Linwood	Carbonate (calcareous and dolomitic siltstone)
Boral Resources	Lobethal	Meta-siltstone
Readymix Holdings	Montacute	Carbonate (dolomite)
Readymix Holdings	Victor Harbor	Meta-sediments
Goolwa Quarries	Goolwa	Quartzite
Clare Quarry	Spalding	Carbonate
McLaren Vale Quarries	McLaren Vale	Carbonate
Boral Resources	Murray Bridge	Quartzofeldspathic gneiss
Boral Resources	Kapunda	Meta-siltstone
Mantina Quarries	Kapunda	Meta-siltstone



SOUTH AUSTRALIAN ROADSEAL AGGREGATE CURRENT AND POTENTIAL SITES

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Figure 1

Some other potential sources of road sealing aggregate across the state are listed in Table 2 (see also Fig. 1). Transport distances to markets are a crucial consideration in the potential use of these sources. For example Gawler Range Volcanics occur over a large area in the north of the state and have good properties for road aggregate but are too remotely located to be used in most South Australian markets.

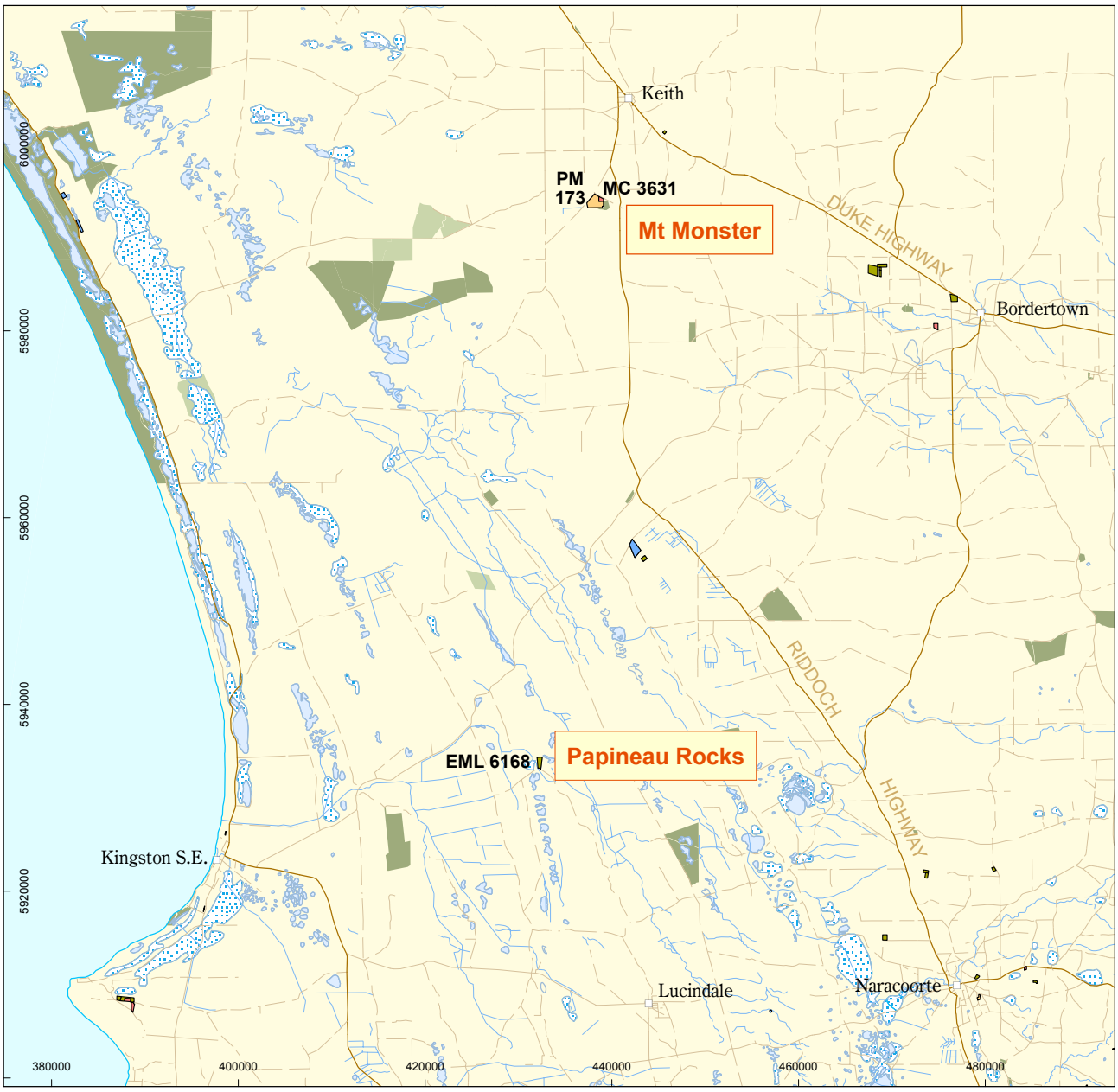
Table 2. Some potential road sealing aggregate sources in South Australia — volcanics

Rock unit, age	Description and history	Resource	Location and distance from Adelaide
Moonta Porphyry Felsic volcanic, Palaeoroterozoic	Host rock to Moonta copper/gold deposits. Pink brown porphyryoblastic rock with plagioclase feldspar disseminated through a xenoblastic groundmass (Janz, 1990). Some aggregate produced from overburden at Poona copper open pit.	Forms basement in the Moonta area and has an elliptical sub-crop area of 27 km^2. Resource potential not demonstrated. Outcrop sparse; overburden depth may preclude most areas.	3 km northeast of Moonta. 167 km from Adelaide.
Carnding Rhyodacite (Gawler Range Volcanics), Mesoproterozoic	Birthday Rail Ballast Quarry. Pink red-brown porphyritic rhyolite	Large resources available. LA 19% Sulphate soundness 0.9%	50 km north of Tarcoola. 680 km from Adelaide by road. Rail access.
Ealbara Rhyolite (Gawler Range Volcanics), Mesoproterozoic	Kingoonya Quarry Porphyritic rhyolite. Provided aggregate for Stuart Highway.	Resources >30 million tonnes, LA 18–19%. (Pain, 1980; RB 80/113).	20 km west of Glendambo. 630 km from Adelaide.
Papineau Rocks rhyodacite, Ordovician	Dark grey green porphyritic rhyodacite. Production from four quarries 1958–59 and 1966–67.	Estimated resource 750 000 tonnes. LA 12–16%.	41.5 km northeast of Kingston and 90 km south of Keith.
Mount Monster rhyolite. Ordovician	Porphyritic rhyolite. Production from two quarries 1955–76.	Significant outcrop limited to Mount Monster area. Estimated resource at northern quarry site 600 000 tonnes or 1 000 000 tonnes.	12 km south of Keith and 237 km southeast of Adelaide.

LOCATION AND ACCESS

The Mount Monster quarries are located 12 km south of Keith and 237 km from Adelaide and are situated adjacent to the northern boundary of the Mount Monster Conservation Park. Access from Keith is south along the Riddoch Highway towards Naracoorte, turning west along the Mount Monster Road, 12 km south of Keith. Entrance to the quarry area is via a track on the southern side of the road, 2.4 km west of the turnoff. Entrance track to the Mount Monster Conservation Park is to the east of the quarry area, 1.4 km west of the turnoff (Fig. 2).

Mount Monster is a slightly elongate hill trending east-northeast, about 12 km south of Keith. The larger northern quarry is 0.8 km north of Mount Monster located on a subsidiary hill named ‘Little Mount Monster’ which has been almost entirely removed by quarrying. The northern quarry lies in Water and Stone Reserve No. 1, Hundred of Stirling on Crown Land vested in the Tatiara District Council. The southern quarry is 200 m to the south on Allotment 11, Hundred of Stirling. Allotment 11 is bounded to the south and east by the Mount Monster Conservation Park.



Mining Production Tenements

- Access Claim (AC)
- Extractive Mineral Lease (EML)
- Mineral Claim (MC)
- Mineral Claim Application (MCA)
- Mineral Lease (ML)
- Miscellaneous Purpose Licence (MPL)
- Miscellaneous Purpose Licence Application (MPLA)
- Private Mine (PM)
- Retention Lease (RL)

- Dual Carriageway
- Principal Road
- Secondary Road
- Minor Road
- Lake
- Land subject to inundation
- Park or Reserve - with mineral exploration access
- Park or Reserve - no mineral exploration access

LOCALITY MAP
Mount Monster — Papineau Rocks Aggregate Sites, Upper South-East Area

Figure 2

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Plate 1. **Mount Monster Northern Quarry, view east-northeast from western end of quarry. Fresh, well-jointed porphyritic rhyolite in northern face of quarry at left. Area of Monarto Mintbush present on elevated area above eastern quarry face at centre right.**

Plate 2. **Mount Monster Northern Quarry, view west-southwest from top of eastern face. Weathered rhyolite of variable depth overlies fresher rhyolite in southern face.**

Plate 3. **Mount Monster Southern Quarry, view southeast from western face. Weathered, kaolinitic rhyolite overlying fresher rhyolite. Mount Monster Conservation Park in background.**

Plate 4. **Mount Monster Southern Quarry, view northeast from southern face. Northern face of relatively fresh rhyolite behind rock dumps.**

MINERAL TENURE AND LAND USE

Mineral Claim (MC) 3631 was pegged by Ross Tenney and Stephen Matthews over the area on Water and Stone Reserve No. 1 within Section 499, Hundred of Stirling. Boral Pty Ltd pegged the same area leading to a dispute considered by the Warden's Court and then the Supreme Court. The Supreme Court ruled in Tenney and Matthews favour and Mineral Claim 3631 was granted in May 2006.

MC 3631 is situated on Crown Land, control of which has been vested in the District Council of Tatiara since 1896 until transfer to the Minister of Environment and Conservation in November 2006 (Figs 3, 4). MC 3631 includes the northern quarry, the former crushing and screening plant and stockpile areas north of the quarry and some areas of native and non-native vegetation. The quarry and stockpile areas have not been rehabilitated since cessation of quarrying in 1976 and faces remain in near original condition. No stockpiles remain on site.

The quarry is 270 m long and up to 85 m wide. Deepest point is about 24 m below the original natural surface of 'Little Mount Monster' shown in Johns (1951). The main bench floor is at about 30 m AHD with a small area at the southwestern end excavated to 21.5 m. The quarry area is accessible to the general public and is often frequented by local people. The lowest bench area contains water and has been used by local people for swimming although water level was low (less than 1 m) in November 2006. No fencing exists to prevent people and/or vehicles from falling over steep faces. Despite this there are no recorded incidents at the quarry and the site appears to be 'accepted' in the current condition by the local community. Pain and Robertson (1981) proposed a final quarry development and rehabilitation program, which has not been adopted.

Private Mine 173 covers a large area to the west and south of MC 3631, including the southern quarry on Allotment 11.

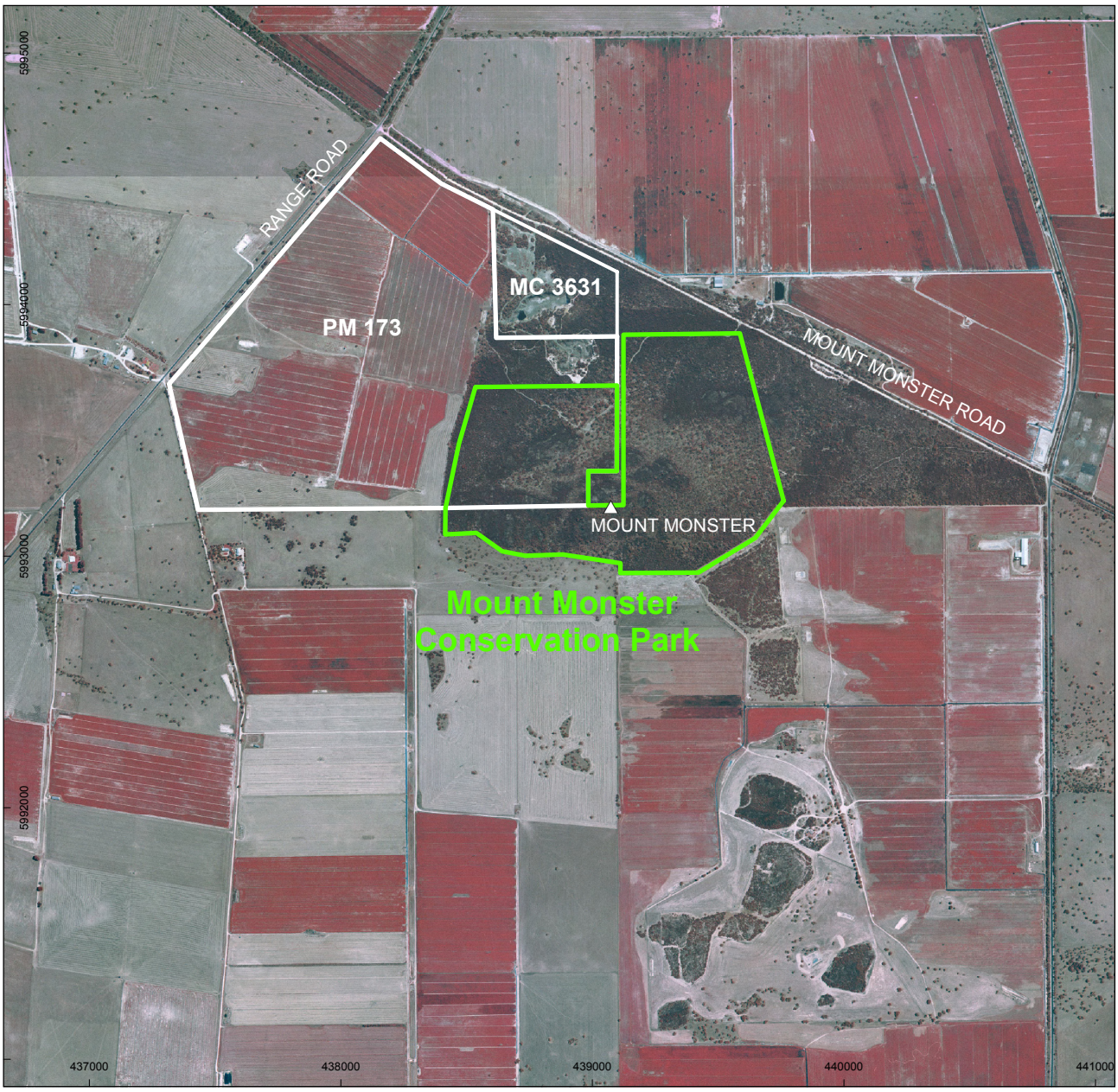
The division of land within the present boundaries of Private Mine 173 is as follows:

- The western portion of PM 173 covers Lots 95, 10 and 2, Hundred of Stirling (Freehold), which are currently utilised for irrigated cropping and livestock.
- The southeastern portion of the Private Mine is within Section 478, Hundred of Stirling, and covers part of the Mount Monster Conservation Park which was singly proclaimed (i.e. no exploration or mining access) in 1976 although PM 173 was already in existence at this time.
- Allotment 11 (Hundred of Stirling) including the southern quarry, is bounded to the north by Water and Stone Reserve No. 1 and to the south and east by Mount Monster Conservation Park. The land is currently freehold owned by the District Council of Tatiara and is in the process of being transferred to the Minister of Environment and Conservation for possible addition to the Conservation Park.

The southern quarry covers an area of about 150 m by 130 m. Quarry floor is about 31 m AHD, a maximum of 12 m below original natural surface. Shallow water was present on parts of the floor in November 2006. As for the northern quarry, the southern quarry site has not been rehabilitated since cessation of quarrying in the 1970s. Some broken rock is present on parts of the quarry floor, probably a combination of oversize material from quarrying and fallen rock from faces. Some regrowth of vegetation has occurred around the quarry.

PM 173 was proclaimed in the name of J.A. Buddle in September 1973 and is currently owned by J. Woodall. The current tenement holders of MC 3631 are believed to be negotiating to buy the Private Mine subject to regulatory approval for resumption of quarrying operations within PM 173 being granted.

A summary of tenements over Mount Monster appears in Table 3.



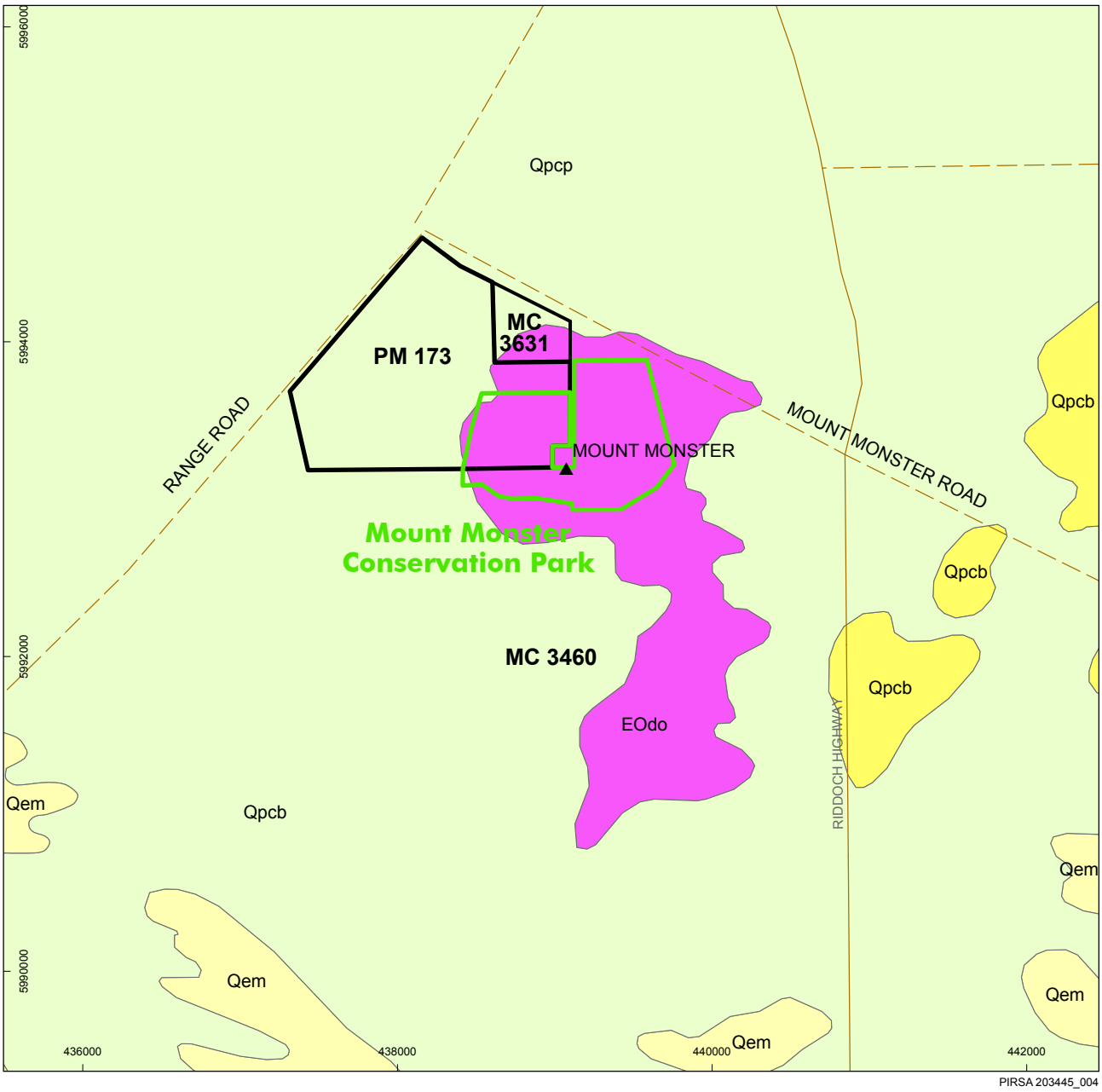
PIRSA 203445_003

0 500 1,000 Metres

Datum GDA94 – Map Projection MGA Zone 54

INFRA RED IMAGE AND MINERAL TENURE MT MONSTER

Figure 3



GEOLOGY

EOdo	ORDOVICIAN. Mt Monster porphyritic rhyolite
Qpcp	QUATERNARY. Padthaway Fm. Lacustrine and lagoonal dolomite, limestone, clay and sand.
Qpcb	PLEISTOCENE. Bridgewater Fm. Subtidal beach and aeolian calcarenite
Qem	PLEISTOCENE-HOLOCENE. Molineaux Sand.

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MT MONSTER GEOLOGY SHOWING OUTCROP AND SUBCROP OF PORPHYRITIC RHYOLITE

Figure 4

Table 3. Mount Monster tenement summary

Tenement	Pegged/granted	Status	Holder/applicant
MC 7052	May 1971	Cancelled January 1972	Quarry Industries
PM 173	September 1973	Active	J. Woodall (J.A. Buddle)
MC 3460, south of park	3/3/2004	Withdrawn 2/3/2005	Willis Draper
MC 3478	26/2/2004	Cancelled	Boral Resources (SA) Ltd
MC 3631, Section 499, Hundred of Stirling. Includes Water and Stone Reserve No. 1.	13/9/2005 Granted 30/5/2006	Active	Stephen Matthews Ross Tenney

Figures 5 and 6 and Table 4 summarise tenure and land use in the immediate area and surrounds of the rhyolite outcrop area and the Mount Monster Conservation Park.

Table 4. Mount Monster land tenure summary

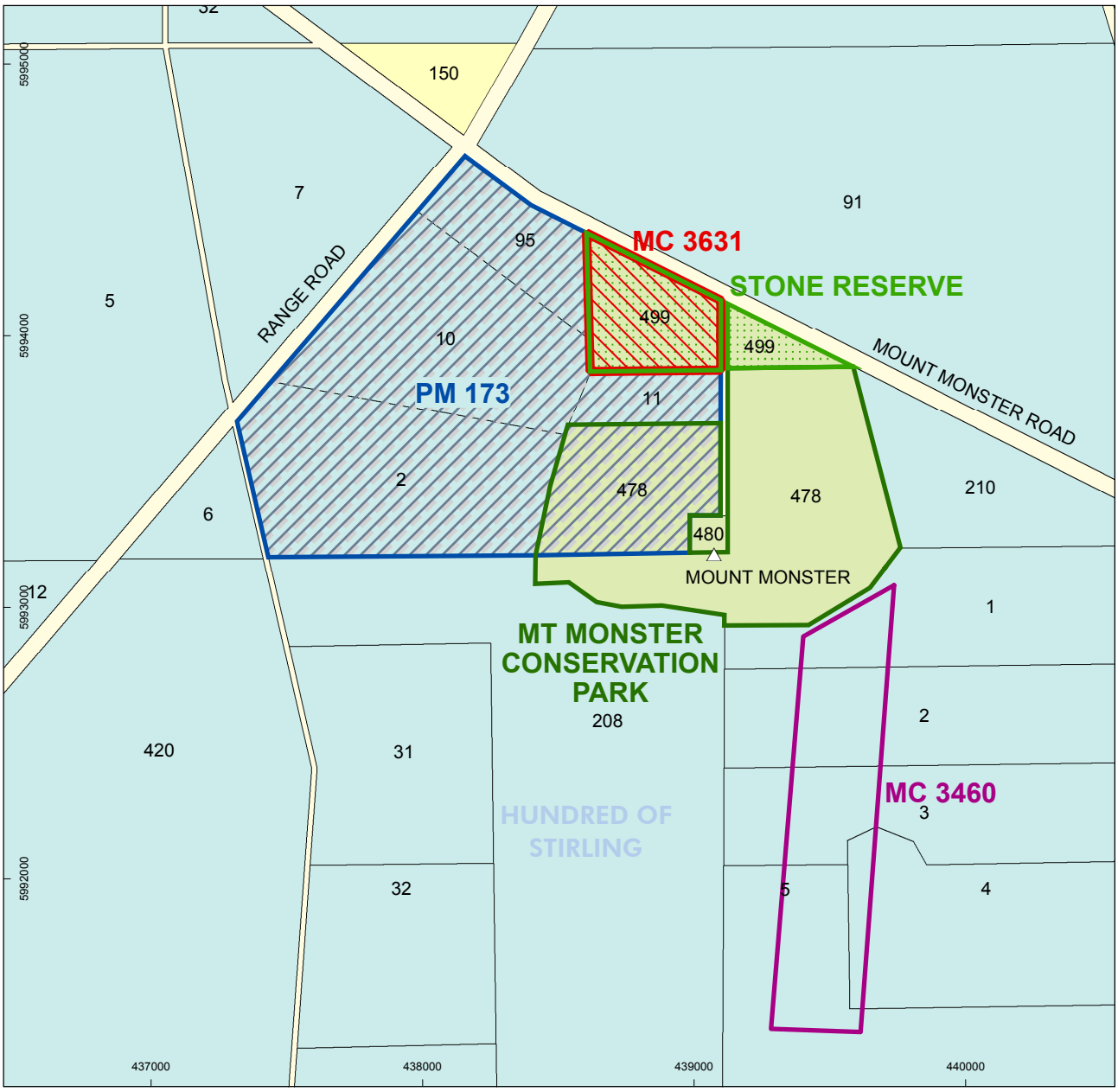
Section	Land tenure	Approximate area (m^2)	Description
499	Crown Land formerly vested in Tatiara District Council. Transferred to Minister of Environment and Conservation – gazetted 23 November 2007.	233 000	Includes Water and Stone Reserve No. 1, northern quarry site.
478	Minister for Environment and Conservation. Crown Land.	916 500	Mount Monster Conservation Park. Includes part of PM 173.
480	Minister for Environment and Conservation. Crown Land.	19 000	Undeveloped Reserve Includes Trig Point and access.
Allotment 11	Freehold Land owned by Tatiara District Council. Transfer to Minister of Environment and Conservation in progress.	102 000	Includes southern quarry site. Part of PM 173.
Lots 2, 10 and 95.	Freehold land.		Land used for agriculture and grazing. Part of PM 173.

The Department for Environment and Heritage are currently seeking to have Allotment 11, Hundred of Stirling (part of PM 173) and Section 499, Hundred of Stirling (Water and Stone Reserve No. 1) added to the Mount Monster Conservation Park (Fig. 7).

REGIONAL GEOLOGY

Geology of the South-East region was summarised by Rogers (1995). The NARACOORTE 1:250 000 geological map (Rochow, 1969) shows the geology of the Keith–Mount Monster region. Outcrop geology of the upper South-East region derived from the PIRSA SA_Geodetail GIS database is shown on Figure 8. Descriptions of igneous rocks in the region include those of Mawson and Dallwitz (1944), Mawson and Segnit (1945), Henstridge (1970) and Burtt and Abbot (1998).

The porphyritic rhyolite quarried at Mount Monster is of Ordovician age (unpublished U–Pb age 464±7 Ma). The unit is designated EOdo on Figure 8. These volcanic rocks are part of a suite of igneous rocks, of granitic composition, which occur as scattered outcrops from the Coonalpyn to Padthaway–Kingston areas along a north-northwesterly basement high known as the Padthaway Ridge. Granites and mafic rocks intrude metasediments and metavolcanics probably belonging to the Cambrian Kanmantoo Group. These metasediments and mafic intrusives do not outcrop and are known from drillhole and geophysical information only. The Mount Monster volcanics and most granites are believed to postdate the Delamerian Orogeny and usually lack any fabric other than some flow banding. The outcrop near Petherick Road (Table 5) may be an exception. Airborne magnetic images suggest the isolated granite outcrops are apophyses or erosional remnants of much larger plutons at depth. Granites seen in outcrop show considerable petrological variation.



Mining Production Tenements, Parks and Reserves

- PM 173 – includes all Allotment 11, part of Section 478 Mt Monster Cons. Pk. Current, J.Woodall.
- MC 3631 – includes part of Section 499, Stone Reserve. Current, S. Mathews and R. Tenney. (Cancelled MC 3478, Boral Resources, covered same area)
- Stone Reserve H400500 Section 499
- Mt Monster Conservation Park
- Allotment 11, District Council of Tatiara community land
- Section 480, Crown Land
- MC 3460, expired, W. Draper.

Land Tenure

- Freehold
- Crown Land
- Crown Lease

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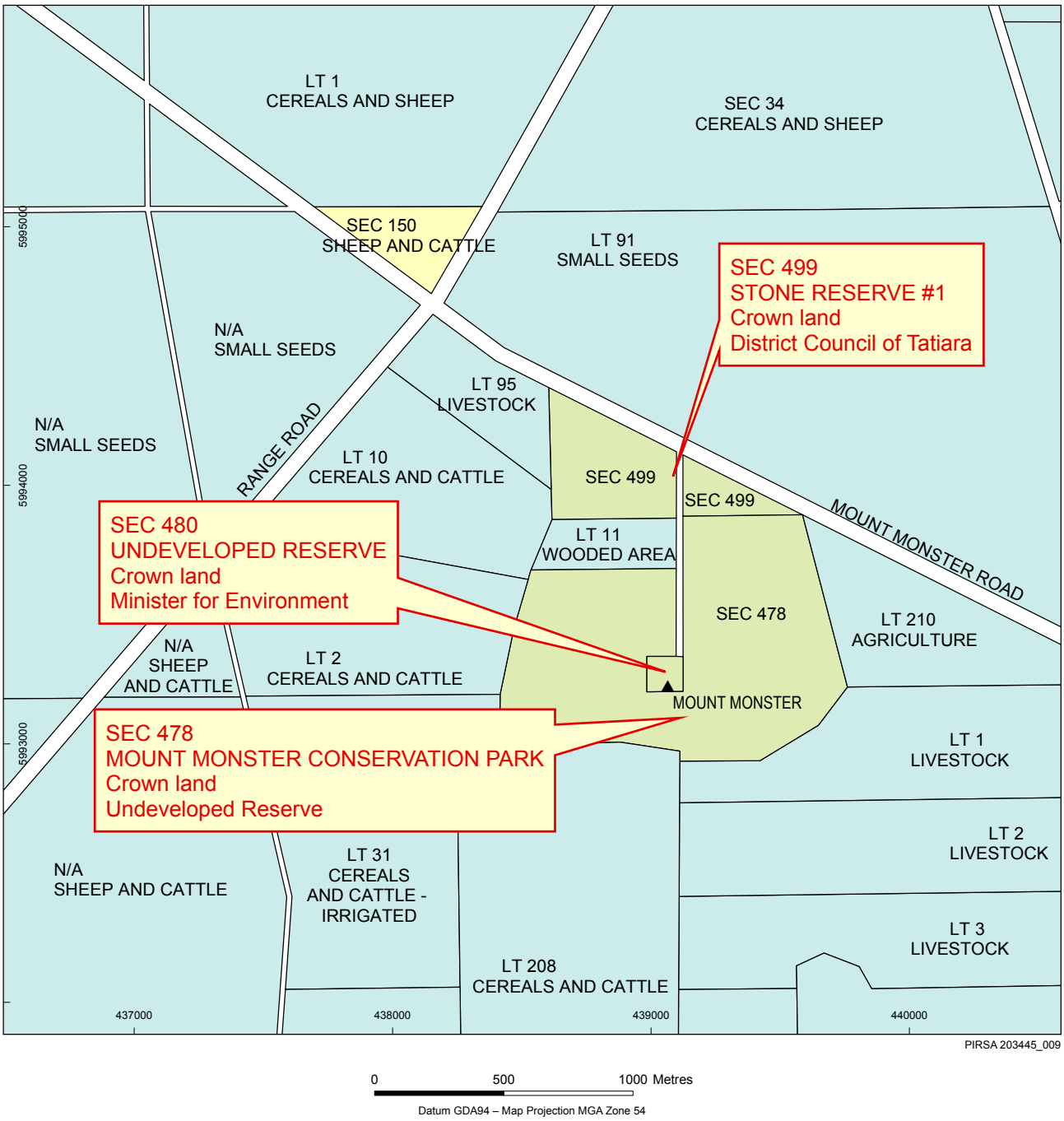
MT MONSTER
LAND AND MINERAL TENURE

Figure 5



Land Tenure

- Freehold
- Crown Land
- Crown Lease

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LAND USE and TENURE

Figure 6

Selected outcrops, particularly volcanic rocks, close to Mount Monster and elsewhere in the region were visited and are described in Table 5 below. The 'Ovaflo' outcrop is not shown on current geological mapping. The outcrop south of Mount Monster on Section 42, Hundred of Willalooka is about 600 m north of and has a much smaller area than that shown on the mapping dataset. No basement rock is present in the area shown on the mapping.

Table 5. Outcrop descriptions

Map unit, area, grid location	Description and comments
EOdo, Mount Monster north face, northern quarry, Section 499, Hundred of Stirling, Water and Stone Reserve No. 1. 438 764 mE 5 994 028 mN	Red-brown coloured, porphyritic rhyolite with quartz, orthoclase and plagioclase phenocrysts in a microcrystalline quartzofeldspathic groundmass. Devitrified lenses may represent modified fiamme (A. Purvis, Appendix 2, Sample R1467217). Quarry faces and outcrop appear uniform in composition and texture. No layering apparent.
EOd4, 3 km east of Mount Monster 443 070 mE 5 992 187 mN (GPS WGS 84)	Carew Road, 'Cluain'. White coarse grained quartz, plagioclase feldspar, biotite granite. Variable joint spacing. No further investigation for aggregate warranted. May have potential for Dimension Stone. Drilling desirable to determine colour with depth and thickness. Freehold land.
EOd4, granite outcrop east of Mount Monster and adjacent to 'Ovaflo' homestead. Not shown on regional mapping. Access off Riddoch Highway or back of 'Ovalfo'. 442 491 mE 5 994 452 mN (GPS WGS 84)	Pink to brown medium grained orthoclase biotite mica granite outcrop. Outcrop area about 500 m east-west, 100 m north-south. Joint direction (east-west) similar to Mount Monster porphyry. Joint spacing close. No further investigation warranted as it is an unremarkable weathered granite. Native vegetation present.
EOdo, approximately 1500 m south-southeast of Mount Monster. Locality called Monster Rock. 439 743 mE 5 992 037 mN	Porphyritic rhyolite as at quarry sites. Outcrop covered with native vegetation including two observed Monarto Mintbushes. Larger population of Mintbush on western side of outcrop estimated at about 300 by DEH. Currently freehold land. Close to expired MC 3460.
EOdo (as for Mount Monster). Shown on map as about 7 km south of Mount Monster. 438 140 mE 5 985 890 mN (actual location) 438 007 mE 5 986 485 mN (approximately centre of outcrop)	Approximately 6.5 km south of Mount Monster, Section 42, Hundred of Willalooka. Pink and green porphyry reported in the vicinity by Henstridge (1970). The rock comprises quartz and feldspar (orthoclase and plagioclase) - phenocrysts in a grey-green microgranular groundmass of K-feldspar, quartz and plagioclase. Some plagioclase overgrowths of K-feldpsar (rapakivi texture). Groundmass texture described as typical of intrusive porphyries (A. Purvis, Appendix 2, Sample R1467191). Outcrop is approximately 1 m in height and occurs as a roughly ovoid feature about 130 m north-south by 80 m east-west. Aggregate properties unknown but substantially different rock texture from Mount Monster. Lease hold land.
EOd1, Section 26, Hundred of Marcollat. 433 031 mE 5 962 221 mN Minnamurra Road. Alternate names include Tee Tree Well and Bin Bin.	Fine-grained grey rhyolite comprising plagioclase feldspar and pyroxene. Outcrop brecciated in parts. Outcrop small (about 10 m in length) and adjacent to seasonal swampland. Further investigation for aggregate not warranted due to small size, inhomogeneity and location. Freehold land.
EOd1, Easter Rocks, near Marcollat. Alamain Road, opposite Namala Homestead. 438 030 mE 5 942 663 mN	Weathered pink to green altered volcanic previously mapped as rhyolite. Brecciated and haematitic in parts. Large outcrop with native vegetation and local wallaby population. Not promising as aggregate source due to location, weathered rock, alteration and native flora and fauna. Freehold land.
EOd1, Papineau Rocks quarries. East Avenue Range, 35 km northeast of Kingston. 432 189 mE 5 933 345 mN (west of No. 1 quarry)	Fine-grained dark grey-green volcanic rock with feldspar phenocrysts. Referred to as rhyodacite but petrology in Rosier and Pain (1982) shows predominantly dacitic composition with lesser rhyolite. Irregular fabric possibly due to flow banding. Patchy weathering, thin to 10 m depth. Four quarries present at site surrounded by native vegetation but no threatened species shown on database.
EOd1, Petherick Road, west of Windsong Homestead. 300 m from Wittacoola Homested driveway. 417 858 mE 5 971 450 mN	Acid volcanic rock compositionally similar to Namala and Papineau. Outcrop is predominantly flow banded rhyolite and rhyolite lava breccia. The outcrop appears inhomogeneous and displays albitisation? and/or silicification? in parts and the quartzo-feldpathic composition is variable. Fabric (flow banding and foliation) within the rocks runs north-south. Bracken vegetation and eucalypts (partly removed) cover the outcrop which appears to have recently experienced a fire. Several old costeans are present on the outcrop. No potential as aggregate source due to inhomogeneity, variable foliation and alteration of the outcrop. The land is freehold.

Petrological descriptions by A. Purvis of Pontifex and Associates of rock samples from the northern Mount Monster quarry and the outcrop on Section 42, Hundred of Willalooka are in Appendix 2. The descriptions suggest a broadly similar composition but different textures. The Mount Monster sample is finer-grained both for the phenocrysts and the ground mass. The sample shows possible fiamme raising the possibility that the rock is an ignimbrite (welded tuff). The Section 42 sample has coarser phenocrysts and groundmass and may be a shallow level intrusive. It could be speculated that the relative uniformity and finer-grained nature of the Mount Monster rock is due to an ignimbritic origin in contrast to origins as lavas or shallow intrusives for other outcrops.

Younger sediments of Tertiary and Quaternary (Pleistocene and Holocene) age overly the Cambrian and Ordovician rocks of the Padthaway Ridge. Surficial sediments surrounding basement outcrop areas include Holocene sand and soil and freshwater swamp and lake sediments (Qhl), lacustrine and lagoonal carbonates of the Padthaway Formation (Qpcp) between ridges of calcarenite of the Bridgewater Formation (Qpcb). Late Pleistocene sands including pale yellow quartz dunal sands of the Molineaux Sand (Qem) are widespread. Tertiary age sand, limestone and clays underlie the surficial units in areas of deeper basement. Groundwater within the younger sedimentary units is extensively used for irrigation.

MATERIAL QUALITY

Pain et al. (1984) summarise the results of material quality testing by the then Highways Department for Mount Monster and Papineau Rocks quarries. A summary of test results is in Appendix 1. Overall material tested for both sites has good properties for use as road sealing aggregate.

Los Angeles abrasion test (LA) results for Mount Monster average about 17%, well within specifications for road aggregate. Sulphate soundness, shape (flakiness), plasticity index and linear shrinkage characteristics are all excellent.

Papineau Rocks material has significantly lower average LA of 13–16% although a greater range of values up to 21% may reflect inclusion of some weathered material in test samples or the poor (flaky and elongate) particle shape. Greater variability is also present in other test results. Crushed aggregate shape characteristics are not as good as Mount Monster but this may reflect the type of crushing plants used and ‘splintering’ of the harder Papineau rock.

SITE GEOLOGY – MOUNT MONSTER

Outcrop area of the porphyritic rhyolite around Mount Monster as mapped by Rochow (1969) is shown on Figure 4. In addition to the Water and Stone Reserve, Allotment 11 and the Conservation Park, the rock occurs as outcrop and sub-crop to the south within land presently utilised for agricultural purposes.

The rock appears to be reasonably homogeneous in composition across the site. Petrological descriptions are in Pain and Robertson (1981) and in Appendix 2. Abundant phenocrysts of pink potassium feldspar, plagioclase and rounded smoky quartz grains are enclosed in a dark red-brown aphanitic groundmass of quartz and feldspar. Minor chlorite is present as an alteration product of biotite and amphibole(?).

A prominent joint set trends about 065°, parallel to the long axis of the northern quarry, and dips about 75° to the southeast. Several other subsidiary joint sets are present. The jointing assists quarrying and crushing of the rock.

At the quarries overburden comprises weathered kaolinitic porphyry, clay with rock fragments, sandy clay, silty soil and patchy calcrete. In the faces of the two quarries overburden is mainly weathered rhyolite varying in depth from 0–5 m. As reported in Pain and Robertson (1981), drilling of seven holes with a small auger rig to establish overburden depth immediately south of the northern quarry was largely unsuccessful in penetrating to fresh rock. Depths to fresh basement in flat areas used for irrigated cropping around the Mount Monster outcrop area are unknown but are likely to be prohibitive for quarrying.

Pump testing and water level observations for the northern quarry in 1979 showed that although the water level in the deepest bench of the quarry was consistent with the local water table, water level during pumping and recovery suggested only very limited groundwater inflow to the quarry floor (21.5 m AHD). Heavy irrigation usage since 1979 is likely to have considerably lowered the groundwater table around Mount Monster. Further investigation of the current groundwater situation would be advisable before resumption of quarrying, particularly for a deeper quarry design.

PRODUCTION, RESOURCES AND DEVELOPMENT

PRODUCTION

Section 499 (Water and Stone Reserve No. 1, the northern quarry) and Allotment 11 (Private Mine 173, the southern quarry) were quarried between 1955–1976 for road sealing aggregate and rail ballast (Pain and Robertson, 1981). Production returns show a total of 548 477 tonnes from the two quarries from 1955 to 1976. Pain and Robertson estimated 214 000 m^3 of in-situ material has been removed from the northern quarry and 92 000 m^3 from the southern quarry suggesting higher total extraction of material than shown in the production returns.

RESOURCES

Pain and Robertson (1981) estimated a resource of 280 000 m^3 (700 000 tonnes assuming bulk density of 2.5) available at the northern site assuming an enlarged pit design, as shown in that report, with extraction to the 21.5 m (AHD) level. The small amount of softer overburden material produced could be utilised for local roadmaking. Another option suggested was extraction of a second 8 m bench to 13.5 m level. Resources for this option were not estimated by Pain and Robertson.

For this report the above estimate has been revised by the removal of the approximately 40 000 m^3 of rock attributable to section H–H' at the eastern end of the quarry. Quarrying of this area is now assumed to be precluded by the presence of the area of endangered Monarto Mintbush immediately east of the present quarry face. A revised suggested final pit outline reflecting this change is shown on Figure 7. This results in an estimate of 240 000 m^3 (600 000 tonnes) for the 21.5 m floor level option. Additional resources available from extraction to the 13.5 m level, using 8 m benches and faces and excluding section H–H', are estimated at 160 000 m^3 (400 000 tonnes).

Resources on PM 173 have not been estimated as part of this report. Substantial extra resources would be anticipated in a larger development incorporating the northern and southern quarries possibly to final depth of 21.5 m AHD. For an estimate of this resource, drilling would be required to investigate overburden depths between the two quarries. A short program with a percussion or other low cost drilling rig would suffice for this purpose. Production of larger amounts of softer weathered rock and other overburden material than for the northern quarry development alone would be anticipated; as mentioned above this material could be used locally for low specification uses. Expansion of the quarry to the south is not considered possible due to the presence of the Mount Monster Conservation Park. Excessive depths to fresh basement rock is likely to rule out any quarrying of the western part of PM 173 on flat, irrigated agricultural land.

NATIVE VEGETATION AND DEVELOPMENT

The presence of threatened (endangered, vulnerable, rare) plant species on the mineral tenements at Mount Monster may influence the direction of any potential future quarrying. On the State GIS database layer 'Plant Populations, Rare, Endangered and Threatened' the following plants are shown as threatened in the vicinity of the Conservation Park, mineral tenements and southern outcrop area.

- Monarto Mintbush – Endangered
- Coloured Spider Orchard – Endangered
- Coast Spider Orchid – Endangered
- Water Starwort – Vulnerable
- Turret Arrowgrass – Vulnerable
- Elegant Spider Orchid – Vulnerable
- Clelands Beard Heath – Rare
- Purple Crassula – Rare
- Fringed Heath-myrtle – Rare
- Spoon Leaf Spyridium – Rare
- Pale Flax-lily – Rare
- Wilson's Honey Myrtle – Rare

The occurrence of the Monarto Mintbush (*Prostanthera eurybioides)* on remnant natural land surface, above the northeastern end of the northern quarry on the Water and Stone Reserve, is a source of considerable concern for some members of the local community, Friends of the Park and DEH. The area containing the Mintbushes has been fenced off and about 250 plants have apparently been counted within the immediate area. The bush also occurs to the south of Mount Monster on a rhyolite outcrop visited by J.K. Hough (author). The bush also occurs around the Monarto area.

Some other native species have grown at the base of benches in the quarries since the completion of quarrying in the 1970s. Replanting of native species could be achieved during the final stages of rehabilitation should quarrying recommence.

The presence of native vegetation in the area between the northern and southern quarries is a problem for any combined development joining the two quarries. The authors are uncertain if any threatened species are present but any quarry development may have to avoid such plants. Native vegetation includes large mallee trees but feral bridal creeper also covered large areas in late 2006. Mining and rehabilitation could include measures to eliminate feral plants in the quarry area and replanting of local native species.

Any quarry developments should incorporate a rehabilitation plan that leaves the quarry sites in a safe, environmentally appropriate and visually pleasing state. Depending on final depths and prevailing groundwater regime a shallow artificial lake could be created during the rehabilitation process.

CONCLUSIONS AND RECOMMENDATIONS

The areas of previous quarrying of Ordovician rhyolite at Mount Monster on Section 499 (Water and Stone Reserve No. 1) and Allotment 11 are the best potential sources of high quality road sealing aggregate in the upper South-East region. Outcrop areas of fine-grained volcanic rock, such as Mount Monster, are rare compared to medium to coarse grained granitic rocks unsuitable for sealing aggregate. Of the other sites investigated, the Papineau Rocks site is capable of producing rock of comparable quality but appears to have greater geological variability, is more difficult to develop due to the configuration of previous quarrying and has much greater transport distance from Keith (about 90 km compared to 12 km for Mount Monster). Other sites of volcanic rock are also remotely located, have small outcrop areas and are inhomogeneous, variably altered or significantly weathered.

The Mount Monster rhyolite outcrop area south of the Conservation Park and subcrop area to the southeast may have potential for aggregate production but any site would need to be investigated with a drilling program to determine rock quality, weathering depths and groundwater levels; threatened plant species are present in the area. In addition, development of a new quarry site at Mount Monster when un-rehabilitated quarry sites are already present appears undesirable.

Resumption of quarrying on Section 499 and Allotment 11 is contentious due to proximity to the Mount Monster Conservation Park, plans by DEH to incorporate both areas into the Park, the presence of native vegetation including threatened species and some local opposition to any resumption of quarrying. Local concern appears to be based both on the vegetation issue and more general opposition to quarrying.

Previously estimated resource at the northern quarry site have been revised to take into account the presence of a significant concentration of the endangered Monarto Mintbush immediately east of the current eastern quarry face. Revised resource estimate is 240 000 m^3 (600 000 tonnes) for quarrying to the 21.5 m (AHD) floor level. Additional resource available if quarrying was extended to the 13.5 m level is estimated at 160 000 m^3 (400 000 tonnes). A larger development incorporating the northern and southern quarries is likely to be contentious due to the presence of native vegetation. Drilling to determine overburden depths would be required before resources for such a development could be estimated.

Any new development of the current quarry sites should take into account threatened native species and leave the sites in a safe, environmentally appropriate and visually acceptable state. The sites are currently frequented by local people and vehicles and could not be considered safe in their current unrehabilitated state. Mining and rehabilitation could include measures to eliminate feral plants in the quarry area and replanting of native species. Investigation of the current groundwater situation is recommended to augment information from a study in 1979, particularly if the deeper quarry option is envisaged.

APPENDIXES

APPENDIX 1: MATERIAL TEST RESULTS SUMMARY, MOUNT MONSTER AND PAPINEAU ROCKS

From Mineral Resources Review 154:49 (Pain et al., 1982)

Aggregate testing, Mount Monster

Test	No. of samples	Results	
Los Angeles abrasion			
Product size (mm)		Average loss(%)	Stand. dev.
15.9-9.9	22	16.8	0.05
9.5-6.4	20	17.5	0.69
Sulphate soundness			
Product size (mm)		Loss (%)	
38 -9.5	1	0.5	
Crusher sand	1	1.7	
19 -9.5	1	0.5	
9.5-4.7	1	1.4	
Shape			
Product size (mm)		Flakiness index (%)	Elongation (%)
19 -6.4	1	19	29
9.5-6.4	1	33	42
Plasticity index and linear shrinkage			
Product size		Plasticity index	Linear shrinkage
Crusher sand	1	1	0.1
Crusher sand	1	2	0.2

Aggregate testing, Papineau Rocks

Test		No. of samples	Results							
Los Angeles abrasion										
Product size (mm)			Average loss (%)				Range			
Spalls	38.1	1	12.0				—			
	25.4	1	12.0				—			
Chippings	19.1-15.9	4	13.8				13-14			
	15.9- 9.5	42	13.0				11-16			
	9.5- 4.8	35	15.9				13-21			
Sand	6.3- 2.4	2	14.0				12-16			
Average least dimension										
Product size (mm)			Average (mm)				Range			
Chippings	15.9- 9.5	18	7.4				0.20-0.33			
	9.5- 4.8	11	4.8				0.17-0.21			
Sand	6.3- 2.4	4	4.1				0.16-0.17			
Liquid/plastic limits, plasticity index, linear shrinkage										
Product size (mm)			L. limit (%)		P. limit (%)		P. index		L. shrink.	
			Avg.	Range	Avg.	Range	Avg.	Range	Avg.	Range
Chippings	19.1-15.9	4	26.6	24.5-28	15.8	15 -17	10	8-13	5	4 -6
	15.9- 4.8	18	22.3	16.8-28	16	11.9-19	6.2	3-14.6	2.8	5 -1.5
Sand	6.3- 2.4	4	25.6	23 -28	16.8	13 -19	8.8	4-14	4.8	4 -6
Crusher dust		8	16.5	11 -17	15	14 -16	1.8	1- 2	0.5	0.1-0.8
Specific gravity										
Product size (mm)			Apparent		Saturated surface dry		Bulk		Water absorp. (%)	
Spalls	38.1	1	2.68		2.66		2.65		0.37	
Chippings	19.1-15.9	1	2.69		2.64		—		1.0	
	15.9- 9.5	2	2.68		2.65		2.63		0.75	
Sand	6.3- 2.4	2	2.63		2.58		2.55		1.12	
Shape and sulphate soundness										
Product size (mm)			Flakiness (%)		Elongation (%)				Sulphate soundness (%)	
Spalls	38.1	1	—		—				1.0	
Chippings	15.9- 9.5	1	40		43				8.3	

APPENDIX 2: PETROLOGICAL REPORT

A.C. Purvis, Pontifex and Associates Pty Ltd.
Mineralogical Report No. 9039, 6 March, 2007.
PIRSA–MER Reference No. EX3238

Two rocks from Keith–Mount Monster region as below.

Sample No.	Location	AMG grid coordinates	Field description
R1467191	Approximately 6.5 km south of Mount Monster, Section 42, Hundred of Willalooka.	438 002 mE 5 986 496 mN	Northeast corner of outcrop. Medium to coarse-grained quartz-feldspar porphyry with grey-green groundmass.
R1467217	Mount Monster north face, northern quarry, Section 499, Hundred of Stirling.	438 764 mE 5 994 028 mN	Red-brown fine to medium-grained porphyritic rhyolite.

Pontifex & Associates Pty Ltd

MINERALOGY – PETROLOGY · SECTION PREPARATION

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MINERALOGICAL REPORT No. 9039

by Alan C. Purvis, PhD.

March 6th, 2007

TO :	N.D. Gray, J.K. Hough PIRSA 4TH Floor, 101 Grenfell Street ADELAIDE SA 5000
YOUR REFERENCE :	Order No. EX3238
MATERIAL :	Two rock slabs of Mount Monster Porphyry
IDENTIFICATION :	1467191, 1467217
WORK REQUESTED :	Thin section preparation, petrographic descriptions and report.
SAMPLES and SECTIONS :	Returned to you with this report.
DIGITAL COPY :	Enclosed with hard copy of this report.

PONTIFEX and ASSOCIATES PTY. LTD.

Summary comments

Two samples of Mount Monster Porphyry are described in this report from thin sections also from their offcuts stained with sodium cobalti nitrite to highlight K-spar (which stains yellow).

Sample 1467191 is relatively coarse-grained and seems to have more abundant phenocrysts (quartz, orthoclase and plagioclase) than the other sample (1467217), which also has more abundant altered mafic phenocrysts (chlorite ± quartz, epidote, carbonate and titanite). This sample 146791 also has a homogeneous microgranular groundmass with an aplitic texture, typical of porphyry groundmasses, whereas that in 1467217 the groundmass is microcrystalline apart from millimetre to centimetre-scale devitrified lenses that may have been fiamme, allowing for this sample representing altered and modified ignimbrite.

Both samples have the composition of syenogranite or rhyolite. Both samples also have minor zircon to 0.15 mm in grainsize, which in 1467191 is mostly in a clay patch with minor fluorite, carbonate, epidote, and chloritic clays. Zircon in 1467217 is mostly enclosed in microphenocrysts of opaque oxide, probably magnetite.

Individual descriptions

SAMPLE	1467191
ROCK NAME (from TS)	Quartz-feldspar-porphyry of syenogranite composition, with secondary sericite, calcite, clays, chlorite and epidote as well as very minor fluorite. Rare zircon to 0.15 mm in grainsize.
HAND SPECIMEN	Quartz-feldspar porphyry with pinkish K-spar and a greyish beige groundmass.

Field note: Mount Monster Porphyry

PETROGRAPHY 1467191

A visual estimate of the modal mineral abundances:

Mineral	Abundance	Origin/location
Quartz phenocrysts	16	Igneous
Orthoclase phenocrysts	22–23	Igneous
Plagioclase phenocrysts ± sericite	12	Igneous
Epidote and carbonate	1–2	Secondary
Clays, chlorite and fluorite	1–2	Ex-mafic minerals?
Zircon	<1	
Groundmass	46	Mostly igneous
Quartz	(16)	Components in groundmass
K-spar	(26)	Components in groundmass
Plagioclase?	(3)	Components in groundmass
Oxide, leucoxene and clay	(1)	Components in groundmass

This sample has abundant partly resorbed bipyramidal quartz phenocrysts to 6 mm in diameter as well as partly resorbed or euhedral orthoclase phenocrysts to 8 mm long, locally with patches of secondary carbonate ± epidote, and weakly sericitised plagioclase phenocrysts to 3 mm long, locally enclosing a large patch of epidote. Both plagioclase and orthoclase phenocrysts occur partly in glomeroporphyritic aggregates, but some orthoclase phenocrysts have inclusions of plagioclase and there are plagioclase phenocrysts rimmed by orthoclase. However, a few orthoclase phenocrysts have partial rims of plagioclase in a rapakivi-like texture. A small clay-patch may have replaced a mafic phenocryst and encloses clay-chlorite aggregates, possibly ex-biotite, leucoxene, and euhedral zircon to 0.15 mm in grainsize. Aggregates of fine-grained colourless to blue zoned fluorite occur in and adjacent to this aggregate, with minor epidote and calcite. Separate clay-chlorite aggregates ± epidote may have replaced microphenocrysts of biotite and/or amphibole.

The groundmass is microgranular and clouded, with most grains less than 0.2 mm in grainsize, but the stained offcut indicates dominant K-spar with less abundant quartz, plagioclase, opaque oxide, leucoxene and clays. Very minor epidote also occurs in the groundmass, which has a texture typically seen in intrusive porphyries.

SAMPLE	1467217
ROCK NAME (from TS)	Weakly altered rhyolite porphyry with quartz, orthoclase and plagioclase phenocrysts as well as altered mafic phenocrysts in a microcrystalline quartzofeldspathic groundmass with devitrified lenses that may represent modified fiamme, allowing the possibility that this represents a modified ignimbrite. Rare zircon is mostly in opaque oxide.
HAND SPECIMEN	Reddish quartz-feldspar-porphyry.

Field note: Mount Monster Porphyry

PETROGRAPHY 1467217

A visual estimate of the modal mineral abundances:

Mineral	Abundance	Origin/location
Quartz phenocrysts	12	
Orthoclase phenocrysts	19	Igneous phenocrysts
Plagioclase phenocrysts	3	
Chlorite ± quartz, epidote, titanite	3	Ex-mafic phenocrysts
Magnetite phenocrysts	4	Igneous
Devitrified lenses	6	Quartz-K-spar ± chlorite
Groundmass	56	Microcrystalline
Quartz in groundmass	(19)	
K-spar in groundmass (+ clays)	(37)	Groundmass minerals
Chlorite and opaque oxide	(<1)	
Zircon, apatite	Trace	Accessories

This is a much finer-grained porphyry compared to the previous sample but has quartz phenocrysts to 4 mm in grainsize, partly rounded and partly resorbed of anhedral. Partly resorbed orthoclase phenocrysts are as much as 5 mm long and are clouded by clays and hematite, with some clouding also in sparse weakly altered plagioclase phenocrysts. Mafic phenocrysts microphenocrysts are more obvious than in the previous sample, to 2.5 mm long, and are mostly altered to chlorite, with quartz, calcite, epidote and titanite in some of these (including the largest phenocryst). Magnetite microphenocrysts are disseminated and enclose most of the zircon in this thin section, as euhedral crystals to 0.15 mm in diameter. There is also trace apatite and a patch of brownish phyllosilicate, possibly biotite. The groundmass is mostly microcrystalline, from 5–20 μm in grainsize, with sparse larger grains, but there are lenses to 10 mm long containing microgranophyric aggregates, quartz and sparse K-spar, possibly representing fiamme in a highly modified ignimbrite.

APPENDIX 3: JOHNS (1951), REPORT BOOK 31/76

DEPARTMENT OF MINES
SOUTH AUSTRALIA

KB 31/76
DM.972/51

GRANITE DEPOSIT - MOUNT MONSTER

(Highways and Local Government Departments)

A deposit of granite situated 7 miles South of Keith township in section 8 (Water and Stone Res. No.1), Hd. Stirling is to be quarried and used as a road metal by the Highways Dept. The deposit was mapped with the assistance of B. Wilson on August 21st, 22nd 1951 with plane table and telescopic alidade to determine the quantity of stone available.

Plan

A plan on a scale of 50 feet to an inch accompanies this report.

Previous Reports

"Palaeozoic Igneous Rocks of Lower South Eastern South Australia" - D. Mawson and W. Dallwitz.

Trans. Roy. Soc. of S.A. Vol.68(2), 1944.

" "Porphyritic Potash - Soda Microgranites of Mount Monster"

D. Mawson and E. Segnit.

Trans. Roy. Soc. of S.A. Vol.69(2) 1945.

Geology

The deposit of granite mapped occurs as an inlier about ½ mile north of Mt. Monster and rises about 80 feet above the general plain level - the outcrop is about 1000 feet long and trends in a north east-south west direction.

The rock has a uniform character and consists of phenocrysts of smoky quartz and pink felspar (average about 1/10 inch across) set in a brown devitrified base of finer texture. Phenocrysts make up about 50% by volume of the rock mass.

The jointing is variable though generally two sets (parallel an transverse to the length of the deposit and at right angles) are developed - these are expected to aid in quarrying and crushing.

Volume of Stone Available.

Down to the 180 feet contour level there are 170,000 cub. yds. of stone available for quarrying. At least 6000 cub. yds. can be expected for every foot of depth quarried below this level.

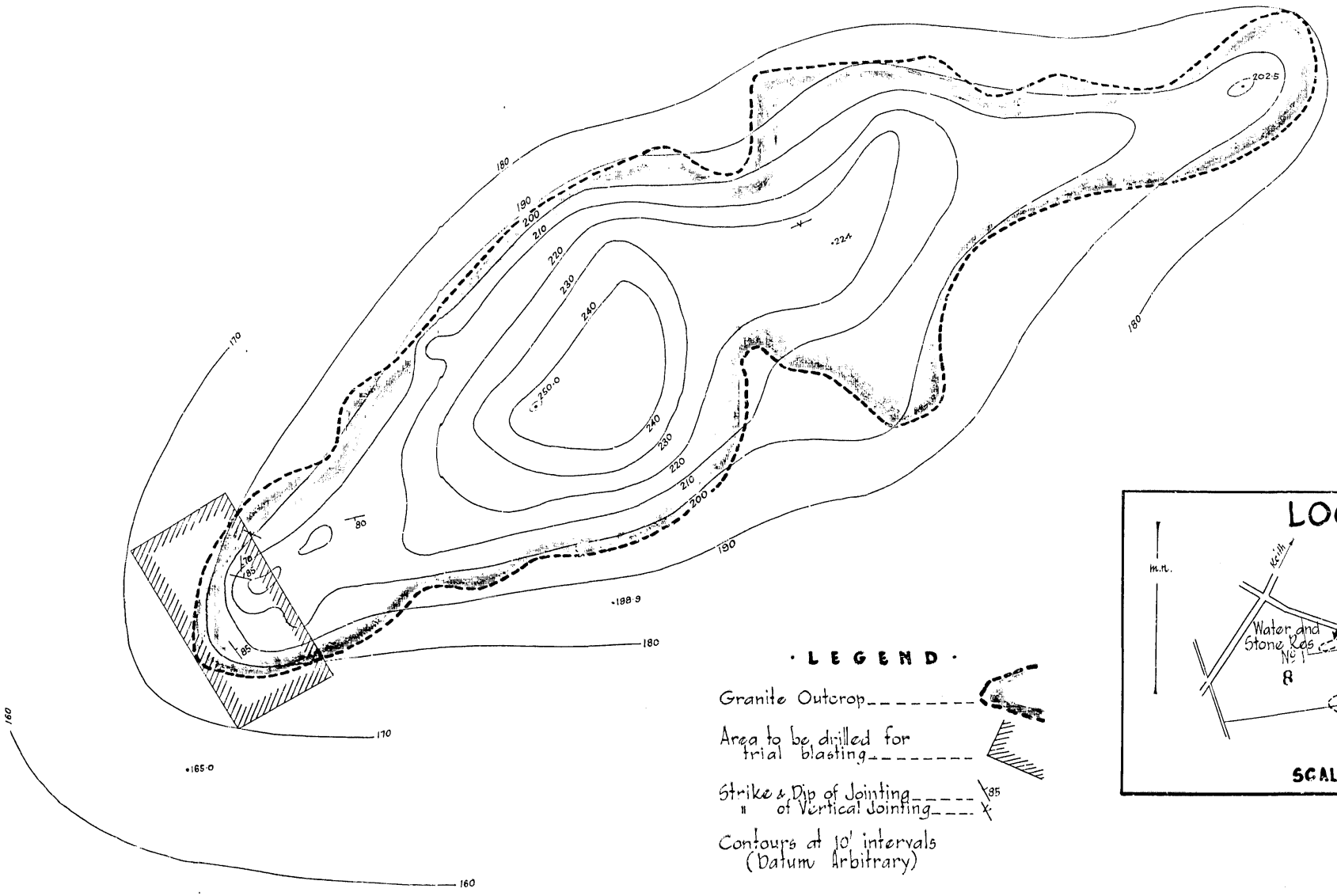
The most suitable site for a quarry would be at the south west end of the deposit where four holes are to be drilled for trial blasting.

R. K. Johns.

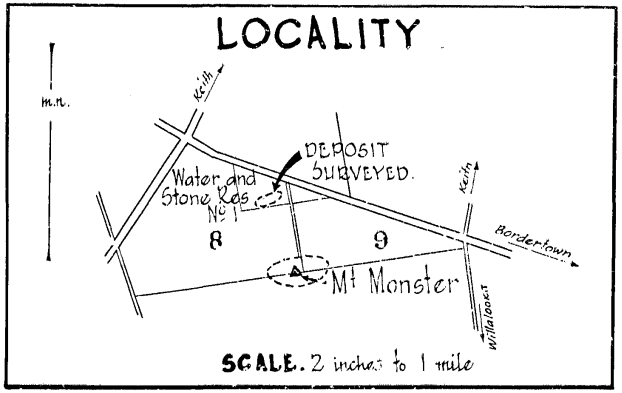
RKJ:EAK
27.8.51

(R.K. Johns)
ASSISTANT GEOLOGIST.

51-264
Kb2



LOCALITY



· LEGEND ·

Granite Outcrop

Area to be drilled for trial blasting

Strike & Dip of Jointing 85

" of Vertical Jointing

Contours at 10' intervals (Datum Arbitrary)

SCALE · FIFTY FEET TO ONE INCH.

S. A. DEPT. OF MINES

GRANITE DEPOSIT · Mt MONSTER

WATER & STONE RES. No 1, Hd STIRLING. (Adj. Sec. 8)

Req. No.
D.M.
Compiled from Plane table Survey by R. K. Johns and R. B. Wilson

Associated Drawing No. | No. | Amendment | Exd. | Date

Approved for Director of Mines | Passed e. & o.

Drn. R. K. J.
Tcd. G. P. K.
Ckd. R. R.
Exd.

Scale 50' to 1 inch.
51-264
Kb2
Date 28 · 8 · 51

APPENDIX 4: PAIN AND ROBERTSON (1981), REPORT BOOK 81/112

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

REPT.BK.NO. 81/112
MOUNT MONSTER PORPHYRY DEPOSIT
NEAR KEITH, MURRAY MALLEE
Geological investigations
1978-1981 hd. Stirling,
co. Buckingham

GEOLOGICAL SURVEY

by

A.M. PAIN

and

R.S. ROBERTSON

DME.657/71

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DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

Rept.Bk.No. 81/112
D.M.E. No. 657/71
Disk No. 1

MOUNT MONSTER PORPHYRY DEPOSIT NEAR KEITH, MURRAY MALLEE
Geological investigations 1978-1981
hd. Stirling co. Buckingham

ABSTRACT

Porphyritic rhyolite of Ordovician age, 900 m north of Mount Monster, 12 km south of Keith has been quarried between 1955 and 1976 to produce 548,477 tonnes of rail ballast and road sealing aggregate. This is an important aggregate resource, being finer grained and more durable than any other known granitic rock in the Murray Mallee and Upper South East of South Australia.

The main quarry lies within Water and Stone Reserve No. 1 which has been under the control of the District Council of Tatiara since 1896. A smaller quarry 200 m to the south lies within Private Mine 173.

A final quarry configuration to yield 280 000 m^3 of rock in situ beneath 70,000 m^3 of overburden will leave an artificial lake 290 m by 130 m and 1.5 to 2.5 m deep, which should prove an added attraction to the nearby Mount Monster Conservation Park.

Preparation of detailed rehabilitation plans for both quarries is recommended.

INTRODUCTION

Outcrop of porphyritic rhyolite north of Mount Monster, and known locally as "Little Mount Monster" was investigated as a source of road sealing aggregate and rail ballast by Johns (1951). Stone was first quarried from the site in 1955, and the last contract was completed in 1976. This is the most important source of road sealing aggregate and rail ballast in the Murray Mallee and Upper South East of South Australia, being finer grained and more durable than other outcrops of medium to coarse grained granite in the region (Rogers, 1980).

Plate 1. Mount Monster Porphyry Quarries. View north from Monster Mount summit. March 1981.

Plate 2. Mount Monster Porphyry Quarry. Water in lower (western) section of quarry covering 21.5 m bench. View east. March 1981.

The quarries are north of the Mount Monster Conservation Park (Fig. 1) which was declared on 30th September 1976. Mount Monster has also been recognised as a geological monument (Toteff, 1979). Stadia surveys of the quarry site were undertaken by this Department in November 1978 and November 1979. A pump test on water 3 m deep in the lowest (western) part of the quarry was carried out in November 1979. Three samples of water were submitted to the E. & W.S. laboratories to determine levels of bacteria, because the western part of the quarry is used as a local swimming hole.

LOCATION, ACCESS & TOPOGRAPHY

The main quarry is situated on Water and Stone Reserve No. 1 and the smaller quarry on section 8, hundred Stirling, county Buckingham within the District Council of Tatiara in the Murray Mallee Planning Area (Fig. 1).

Access from Keith is southwards along the Keith to Naracoorte Road turning southwestwards along Range Road 6.5 km south of Keith and then southeastwards after 3.5 km. The track into the quarry is to the south, 0.5 km from the second intersection.

Mount Monster is a slightly elongate hill trending east-northeast, about 11 km south of Keith. The peak is about 80 m above sea level and 50 m above the surrounding plain.

The small quarry is situated on the northern slope of Mount Monster.

The main quarry is 0.8 km north of Mount Monster on a subsidiary hill 'Little Mount Monster' which has been almost entirely removed by quarrying.

MINERAL TENURE AND PRODUCTION

The main (northern) quarry is on Crown Land designated Water and Stone Reserve No. 1, control of which has been vested in the District Council of Tatiara since 1896.

Mineral Claim 7052 over part of the area of the southern quarry was granted to Quarry Industries Ltd on 24 May 1971 but was cancelled on 5 January 1972.

Private Mine 173 which covers section 8 hundred Stirling adjoining Water and Stone Reserve No. 1, was proclaimed in the name of J.A. Buddle on 13 September 1973 (Fig. 1).

Production from the two quarries as reported in returns to this Department is detailed in Table 1.

TABLE 1

Production of Aggregate, Mount Monster

Year	(tonnes)
1955	32 363
1956	26 926
1967	47 367
1968	33
1971	119 826
1972	160 670
1973	108 283
1975	52 625
1976	384
TOTAL	548 477

An estimated 214 000 m^3 of in situ material have been removed from the quarry in Water and Stone reseve No. 1, and 92 000 m^3 from Private Mine 173.

Plate 3. Mount Monster Porphyry Quarry. View west with 30 m bench in centre. March 1981.

Plate 4. Mount Monster Porphyry Quarry. View south. Old quarry and Mount Monster Conservation Park in background. Overburden of weathered kaolinitic porphyry reaches a maximum thickness of 5 m. March 1981.

GEOLOGICAL SETTING

The regional geology is detailed on NARACOORTE (Rochow, 1969). The rock at Mount Monster is part of a suite of granitic igneous rocks of Ordovician age which outcrop along the northwesterly trending basement high, known as the Padthaway Ridge.

The plain surrounding Mount Monster is underlain by flat-lying Cainozoic sediments, being predominantly clay and sandy limestone. These sediments contain groundwater which is heavily utilized for irrigation purposes.

SITE GEOLOGY

The rock quarried at Mount Monster is quartz-feldspar porphyry. The dark red-brown aphanitic groundmass of quartz and feldspar encloses subhedral to euhedral potash feldspar and plagioclase phenocrysts up to 10 mm long, and rounded smoky quartz grains. Petrographic descriptions are included in Appendix 1.

The most prominent joint set in the main quarry trends about 065°, parallel to the length of the quarry. Dip is about 75° to the southeast, and spacing is about 0.2-1.0 m.

Subsidiary joint sets include:-

strike about 005°, dip 80° to east

strike about 340°, dip 75° to northeast

strike about 300°, dip 60°-85° to northeast

Overburden comprises weathered kaolinitic porphyry, clay with rock fragments, brown sandy clay, silty soil, and patchy calcrete. In the faces of the main quarry, thickness varies from nil on the northern face to 5 m on the southern face (see cross sections, Fig 3.).

The platform near the crusher ramp adjacent to the northern quarry face has been built up from overburden, oversize spalls, and concrete blocks.

MATERIAL QUALITY

Results of aggregate testing by the Highways Dept. are summarised in Table 1. All Los Angeles (L.A.) Abrasion Test results are within contract specifications for road aggregate. The material is reported to have adequate bitumen affinity.

TABLE 2

Aggregate Testing, Mount Monster

Los Angeles Abrasion Test

Product Size	No. of Samples	Average Loss %	Standard Deviation
-15.9 mm (5/8") + 9.9 mm (3/8")	22	16.8	1.05
- 9.5 mm (3/8") + 6.4 mm (¼")	20	17.5	0.69

Sulphate Soundness

Product Size	No. of Samples	Loss %
- 38 mm (-1½") + 9.5 mm (3/8")	1	0.5
Crusher sand	1	1.7
- 19 mm (3/4") + 9.5 mm (3/8")	1	0.5
- 9.5 mm (3/8") + 4.7 mm (3/16")	1	1.4

Flakiness, Elongation

Product Size	No. of Samples	Flakiness Index %	Elongation %
- 19 mm (3/4") + 6.4 mm (¼")	1	19	29
- 9.5 mm (3/8") + 6.4 mm (¼")	1	33	42

Plasticity Index & Linear Shrinkage

Product Size	No. of Samples	Plasticity Index	Linear Shrinkage
Crusher sand	1	1	0.1
Crusher sand	1	2	0.2

DRILLING

A programme of 7 holes totalling 12.25 m was drilled on 11 March 1981 using a Departmental power auger mounted on a Daihatsu light truck.

The holes were sited as shown on Figure 2 to determine overburden depths adjacent to the southeastern face of the main quarry, but stiff clays and rock fragments prevented penetration to fresh rock. Locations of the holes are shown on Figure 2 and logs are presented in Appendix 2.

PUMP TESTING

To determine the feasibility of dewatering the quarry and working below water level, pump testing was undertaken on 20 November 1979. Results of the test are included in Appendix 3.

There was only slow recovery of the water level in the quarry after the pump was turned off. Hence, dewatering will be simple, and inflow of groundwater during quarrying operations is expected to be negligible and easily controlled.

Seasonal fluctuation of water level in the quarry floor was monitored throughout 1980 and found to parallel that in Observation Well 6925-503 1 km to the southwest (Appendix 3). Water levels fluctuated from about 23 m (AHD) in Summer 1980 to 24 m in Spring (Appendix 3).

WATER QUALITY

The water in the deepest part of the quarry is a popular swimming hole, and has been stocked with fish by local residents.

Samples of water which were taken at three random sites were found by the E. & W.S. Department to be suitable for swimming but not for drinking purposes. Test results are detailed in Table 3.

TABLE 3

Water Quality, Mount Monster Quarry

Site	Total Coliforms per 100ml	E. Coli per 100ml	Plate Counts (Organisms per m at 20°C	at 35°C
1	1	1	260	130
2	9	1	260	140
3	15	Absent	380	100

QUARRY DEVELOPMENT AND RESERVES

Water and Stone Reserve No. 1

The quarry is 270 m long, 100 m wide and 24 m below natural surface. Benches have been developed at levels of 40 m, 30 m and 21.5 m (A.H.D.). The lowest point at RL of 20.7 m is on the floor against the northeastern face.

The screening plant and main dump of scalps, 100 m north of the quarry, cover about one hectare. There are no stockpiles of aggregate left on site.

The following three options were considered for future development of the quarry.

1. To rehabilitate the quarry by blowing down the faces and back-filling the 21.5 m floor and the eastern part of the 30 m bench where water ponds during winter months to provide a dry quarry floor.
2. To maximise the yield of aggregate by widening the quarry and developing one bench below the existing deepest point at R.L. 20.7 m. A permanent body of water will result, approximately 250 m by 80 m and 16 m deep.
3. To widen the quarry and work the whole quarry to the 21.5 m level. A permanent body of water will result, fluctuating between 1.5 m deep in Summer and 2.5 m in Spring.

Option 3 is considered the most appropriate. Option 1 sterilises a valuable resource, and option 2 results in a deep body of water which may be considered dangerous, particularly in an area readily accessible to the public.

Proposed development using Option 3 is shown on Figure 2 and cross-sections in Figure 3. Yield will approximate 280 000 m^3 of in situ rock below 70 000 m^3 of overburden.

The final faces should be blasted and quarry sand and scalps dumped around the edge of the lake to form an artificial beach. The final dimensions of the lake will approximate 290 m by 130 m. There are adequate quantities of scalps available and more will be produced with further crushing.

Private Mine 173

The quarry is 150 m long, 130 m wide and 12 m below natural surface. The pit floor is approximately at RL 30.7 m, with only remnants of an upper bench at 34 m.

Further development is not warranted because of the depth of overburden in the southern faces. The quarry should be rehabilitated during the next crushing contract in the main quarry by placing spalls against the faces and covering with overburden.

CONCLUSIONS AND RECOMMENDATIONS

By widening the quarry in Water & Stone Reserve No. 1 and extending the floor to maximum extent 280 000 m^3 tonnes of rock will be available beneath 70 000 m^3 of overburden. Although the quarry will have to be pumped dry before operations recommence, inflow of groundwater will be slow and easy to control. At the end of operations, the abandoned quarry would be expected to fill with water to a depth of approximately 1.5 to 2.5 m.

As the quarries and adjacent Mount Monster Conservation Park are already a popular picnic site, an artificial lake will further enhance the area for recreation.

Rehabilitation of the abandoned quarry on PM 173 should be carried out during the next crushing contract in the main quarry.

The preparation of a detailed rehabilitation programme by this Department in consultation with the District Council of Tatiara and the Department of Environment and Planning is recommended.

AMP/RSB:GU

A.M. PAIN
Senior Geologist,
Extractive Minerals

R.S. ROBERTSON
Geologist,
Mineral Resources

REFERENCES

Johns, R.K., 1951. Granite deposit - Mount Monster. S.A. Dept. Mines report 31/76 (unpublished).

Rochow, K.A., 1969. NARACOORTE map sheet. Geological Atlas of South Australia 1:250 000 series. Geological Survey S. Aust.

Rochow, K., 1971. The Padthaway Ridge. In: Wopfner, H. and Douglas, J.G. (Eds.). The Otway Basin of Southeastern Australia. Spec. Bull. geol. Survs. S. Aust. Vict., pp.325-337.

Rogers, P.A., 1980. Geology of the South East, South Australia, Geological Atals Special Series, 1:500 000. Geol. Surv. S. Aust.

Toteff, S., 1979. Mount Monster In: Toteff S. and McBriar, E.M., Geological Monuments in South Australia, Part 2:80-82. Geol. Soc. Aust. (unpublished).

APPENDIX 1

Petrographic descriptions by Dr. F. Radke of two rocks from Mount Monster extracted from 'The Geochronology of the Granitic Rocks of South East South Australia' - Progress Rpt. Bk. No. 9.

Sample: Pl507/74: TS32687

Rock Name:
Porphyritic rhyolite

Hand Specimen:
A massive rock consisting of a dark brown to tan coloured aphanitic matrix through which abundant pink feldspar and black quartz phenocrysts are disseminated.

Thin Section:
An optical estimate of the constituents gives the following:

	%
Felsic matrix	55
Potassium feldspar phenocrysts	25
Plagioclase Phenocrysts	5
Quartz phenocrysts	10
Chlorite	1
Biotite	trace
Sericite	trace
Apatite	trace
Opaques	1
Epidote	1

This sample consists essentially of feldspar and quartz phenocrysts disseminated through a felsic matrix. Most of the felsic matrix has a very fine grain size (below 0.01 mm) with a cherty, interlocking granular texture but locally the matrix has a coarser grain size with an interlocking granular to spherulitic texture. In many cases the coarser grained matrix with spherulitic textures occurs marginal to phenocrysts. The feldspar phenocrysts consist mainly of K-feldspar although some smaller plagioclase phenocrysts are also present. Most of the K-feldspar phenocrysts have subhedral to anhedral shapes with local embayments. The plagioclase phenocrysts generally show subhedral to euhedral shapes. All of the plagioclase phenocrysts and most of the K-feldspar phenocrysts have turbid, brown appearance produced by very fine micron sized inclusions probably of hematitic material. Most of the larger K-feldspar phenocrysts have clear cores with turbid rims which indicate that the turbidity was produced by alteration probably of late magmatic origin.

The quartz phenocrysts are up to 1 mm in size and typically show anhedral, embayed shapes.

A few well developed crystals of biotite with intense pleochroism in shades of green are distributed through the rock. But most of the primary mafic minerals have been altered to a dark green chlorite which forms flaky patches up to 0.5 mm wide within the matrix. Granular epidote is intergrown with many of the chlorite-rich patches but also occurs as individual grains distributed through the matrix. Traces of sericite occur as an alteration product of some feldspar phenocrysts.

A single large crystal (about 1 mm long) of a zoned, pleochroic brown tourmaline was observed in thin section. Traces of apatite and minor amounts of small anhedral opaque grains are disseminated through the rock.

This sample is a porphyritic rhyolite which has undergone minor alteration to produce a turbid character in much of the feldspar as well as also much of the primary mafic minerals (mainly biotite) to chlorite and minor epidote. The rock basically has a very fresh appearance and should be suitable for radiometric dating.

Sample: P1508/74: TS32688

Rock Name:
Rhyolite

Hand Specimen:
A massive rock consisting of a brown to tan coloured aphanitic matrix with abundant phenocrysts of pink feldspar and black quartz.

Thin Section:
An optical estimate of the constituents gives the following:

	%
Felsic matrix	55
K-feldspar phenocrysts	25
Plagioclase phenocrysts	5
Quartz phenocrysts	10
Chlorite	2
Epidote	trace-1
Carbonate	trace-1
Sericite	trace-1
Apatite	trace
Zircon	trace
Opaques	1

This sample consists essentially of quartz and feldspar phenocrysts cemented through a very fine grained felsic matrix with localised coarser grained areas with a granular texture. It is basically very similar to sample P1507/74 in mineralogy, texture and origin.

The feldspar phenocrysts have a turbid appearance identical to that described in sample P1507/74. The chlorite forms patches up to 0.5 mm in size which locally show prismatic shapes which are pseudomorphic after primary mafic minerals. Some of the chlorite patches have prismatic shapes and probably represent completely altered amphibole phenocrysts. Granular epidote and carbonate are intergrown with some of the chlorite patches. Minor alterationof the plagioclase to produce fine sericite flakes is more extensive in this sample than in sample P1507/74.

Traces of apatite and zircon are disseminated through the rock as are minor anhedral opaque grains. This sample is a rhylitic volcanic rock which has a very fresh appearance and should be suitable for radiometric dating although it does not appear to be quite as fresh as sample P1507/74.

APPENDIX 2

Geological Logs of Auger holes

APPENDIX 2

AH 1	0.0 m - 2.0 m	Olive brown sandy clay with some porphyry rock fragments.
	2.0 m - 2.5 m	yellow brown sandy clay. Drill unable to penetrate boulder.
AH 2	0.0 m - 0.3 m	Brown clayey sand with porphyry rock fragments. Drill unable to penetrate.
AH 3	0.0 m - 0.3 m	Brown clay with rock fragments. Drill unable to penetrate.
AH 4	0.0 m - 0.35 m	Red brown sandy clay soil.
	0.35 m	Calcrete. Drill unable to penetrate.
AH 5	0.0 m - 0.3 m	Brown clay soil.
	0.3 m - 1.0 m	Brown clay soil with some calcrete.
	1.0 m - 2.9 m	Olive brown sandy clay.
	2.9 m	Drill unable to penetrate calcrete or porphyry fragment?
AH 6	0.0 m - 1.0 m	Brown sand clay.
	1.0 m - 1.8 m	Brown sandy clay with some calcrete.
	1.8 m - 2.7 m	Stiff red brown sandy clay. Hole stoped.
AH 7	0.0 m - 0.8 m	Off white fine graned silty sand.
	0.8 m - 3.2 m	Yellow brown sandy clay.
	3.2 m	Stiff yellow brown sandy clay. Hole stopped.

APPENDIX 3

Results of Pump Test and Water Level Observations - Mount Monster Quarry

By

M.F. Stadter
Regional Geologist
NARACOORTE

Mount Monster Quarry Investigation

Following a request from the Mineral Resources Division to determine the groundwater inflow component at the Mount Monster Quarry, partial dewatering of one of the pits in the quarry was carried out using a centrifugal pump. Date of pump test was 20/11/79.

A cross-section through the quarry and a plot of the elevation of the water table (A.H.D.) shows that the water table has been exposed in the dewatering pit (see plan S15985). This has been confirmed from colour aerial photography flown in March, 1978 and from local inhabitants who use the pit as a swimming hole in summer.

The dimensions of the dewatering pit are as follows - about 30 metres long and 28 metres wide with an average depth of water of approximately 3.0 metres.

The pit was pumped for a period of 375 minutes at an average rate of 4920 kilolitres per day. The total drawdown for the period was 1.362 metres, and the test was stopped at 375 mins. due to an insufficient head of water above the pump suction. A plot of the drawdown versus time is appended (plan S15980).

A plot of the drawdown versus the cumulative volume of water pumped (plan S15981) approximates to a straight line indicating that most of the water pumped is from storage with little groundwater inflow. The deviation of the last few drawdown values from the straight line probably reflects a more marked change in the dimensions of the dewatered zone.

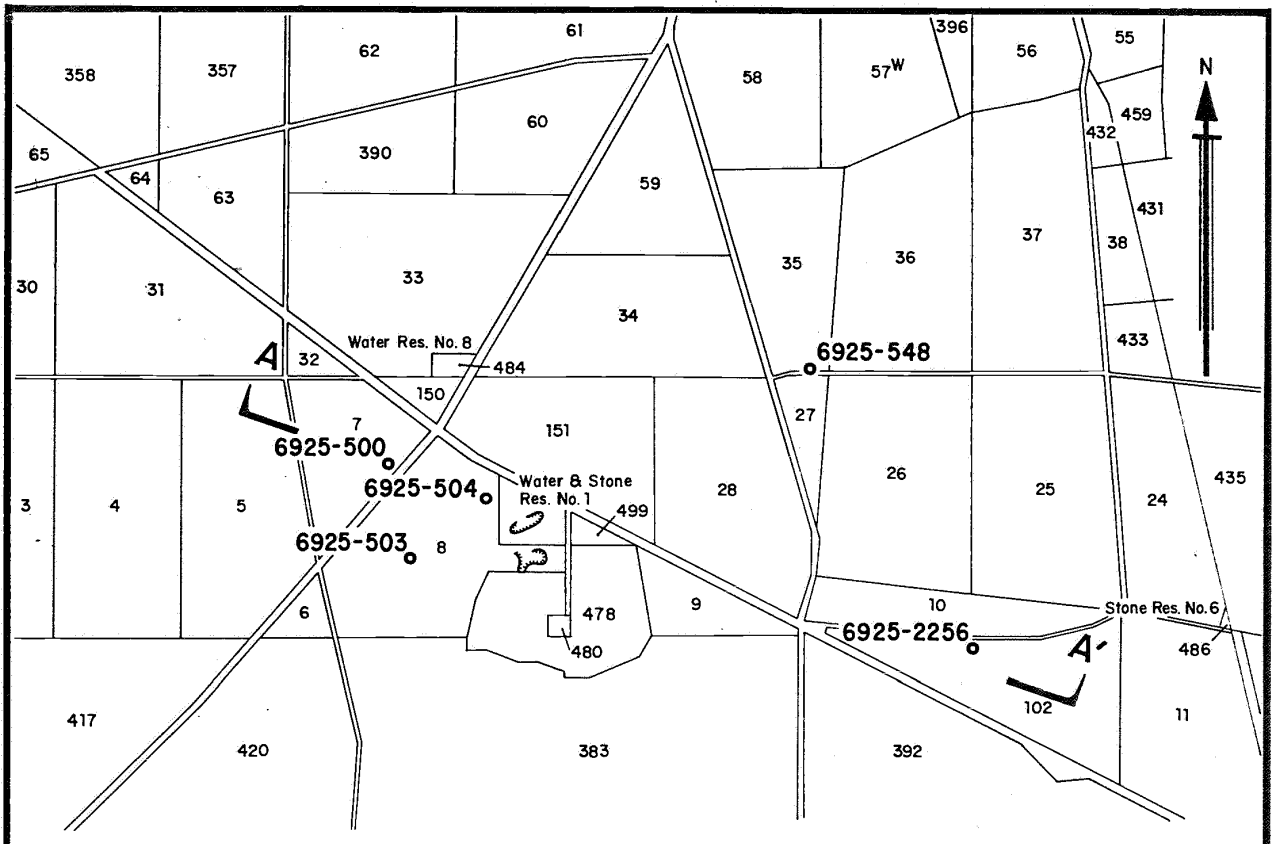
Recovery measurements were taken from the time pumping ceased and a plot of the residual drawdown versus time is presented in plan S15982. The results show a recovery of 0.219 metres in 63.75 hours since pumping ceased, which represents an

inflow of about 69 kilolitres per day. Recovery of the water level in the dewatering pit was monitored for nearly 10 days, and towards the end of this period the water level had stabilised at about 1.08 metres below the original water level.

In summary, the results of the test have shown that the groundwater inflow is quite small and quarrying operations could be carried out beneath the water table provided the limestone aquifer in contact with the quarried material is not exposed.

Disposal of any pumped water during dewatering could be carried out effectively to one or more trenches in the limestone aquifer adjacent to the quarry.

To determine the seasonal variation of the water table, monthly water level monitoring will be carried out in conjunction with an existing observation well network in the area.

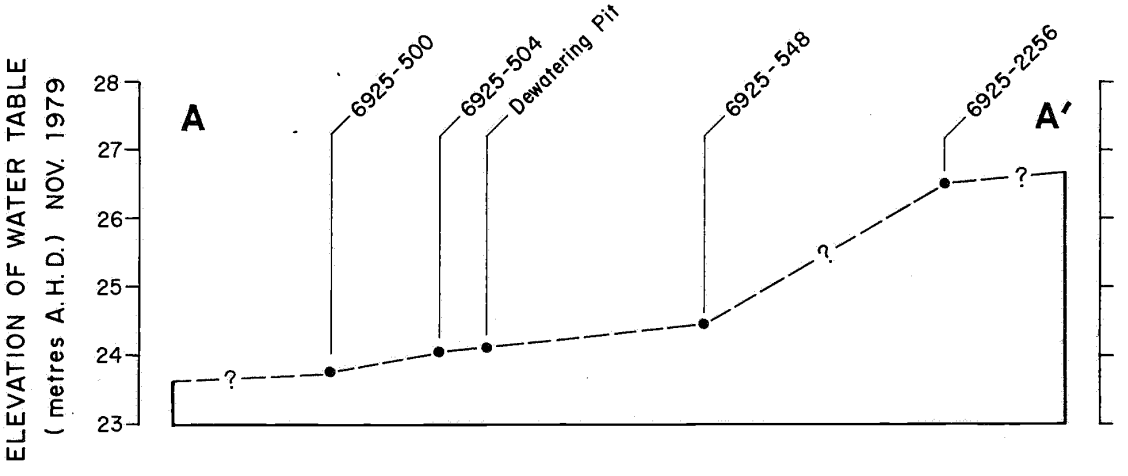


6925-548 Well with Unit Number (abbrev.)

Quarry

SCALE IN KILOMETRES

1 0 1 2 3 4



Appendix 3 P. 3

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

MT MONSTER PORPHYRY DEPOSIT

WATER & STONE RESERVE Nº 1 · HD. STIRLING

ELEVATION OF LOCAL WATER TABLE

COMPILED M.H.S.	14·1·82 C.D.O DATE
DRAWN N.R.S.	SCALE 1: 50 000
DATE 27-11-81	PLAN NUMBER S15985
CHECKED	

2485

2485

MF 50

COMPILED M. H. S.

DRN M. B. | CKD

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

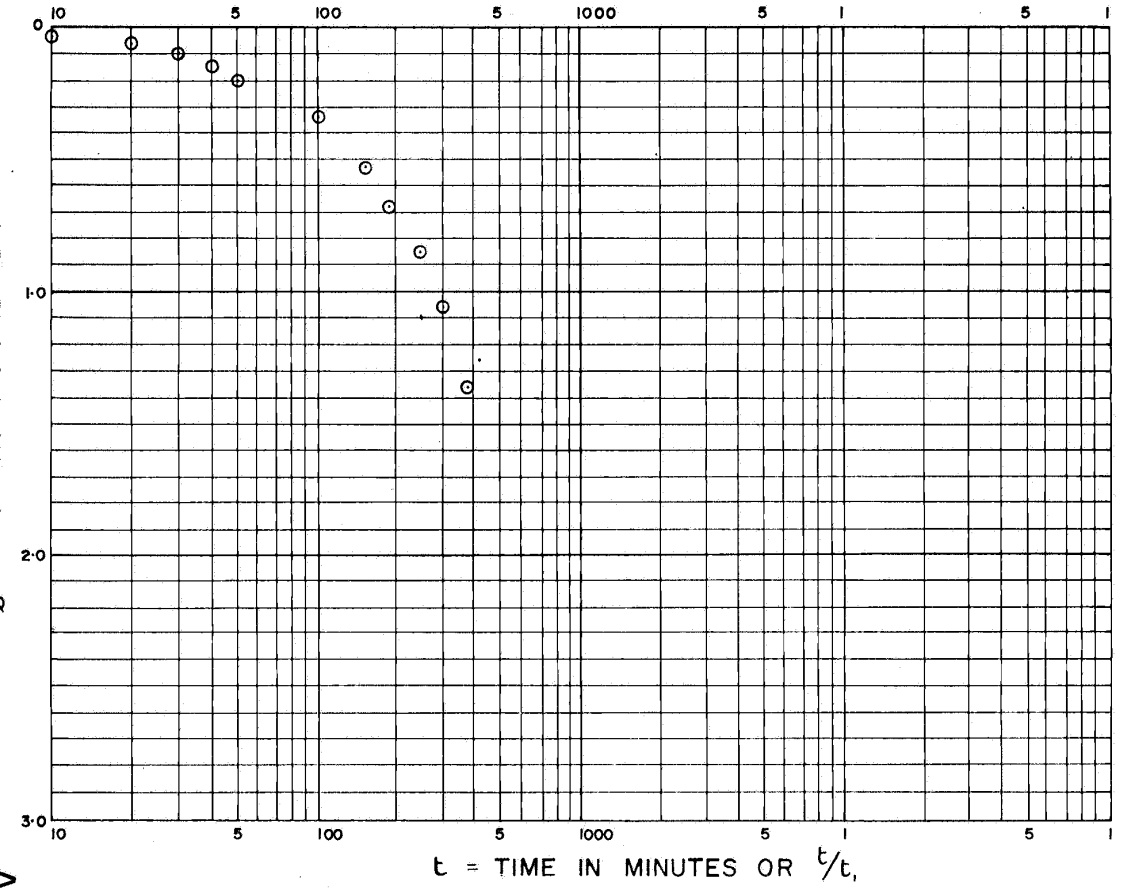
MT. MONSTER PORPHYRY DEPOSIT
DRAWDOWN Vs TIME – DEWATERING PIT
WELL No. 6925000WW00503
CONSTANT DISCHARGE TEST

SCALE

DATE 30-11-81

PLAN NUMBER
S15980

Appendix 3 P. 4



STATE/UNIT No. _____

PRODUCTION/OBSERVATION WELL

INTERVAL TESTED

From _____ m. to _____ m.

HOLE DEPTH _____ m.

AQUIFER THICKNESS _____ m.

DEPTH OF PUMP INTAKE _____ m.

DEPTH OF WATER LEVEL

AT TEST START _____ m.

AVAILABLE DRAWDOWN _____ m.

JACOB EQUATIONS*

$$T = \frac{0.183 \times Q}{\Delta s} \quad \text{in which}$$

T = Transmissivity (m^3/day/m.)

Q = Pumping rate (m^3/day)

Δs = Drawdown per log cycle (m.)

$$S = \frac{2.25 \times Tto}{1440\, r^2} \quad \text{in which}$$

S = Storage coefficient

to = Zero drawdown time (minutes)

r = Distance to Observation Well (m.)

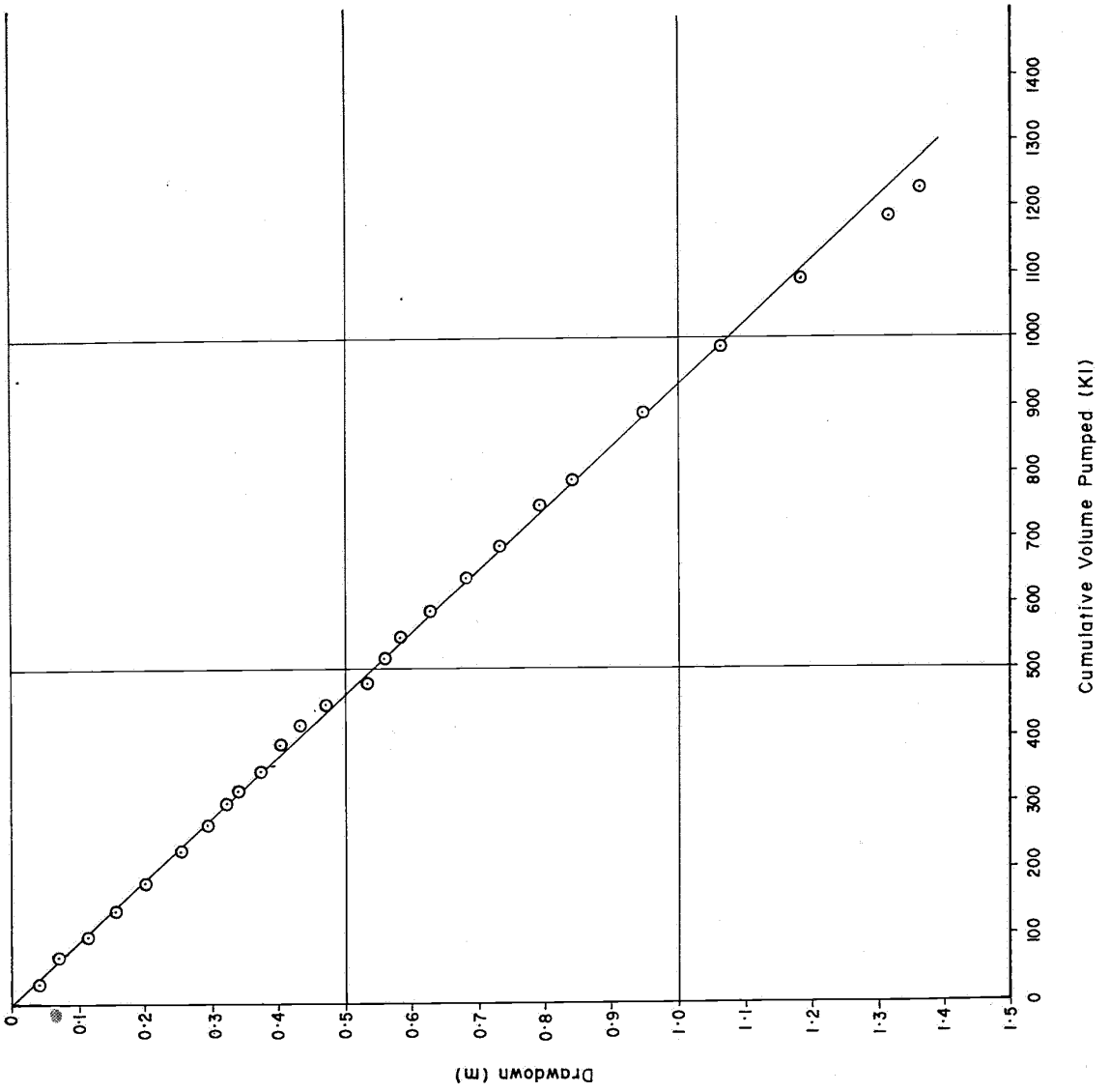
Date of test 20-11-79

DATA

Q Δs to r

CALCULATIONS

* Check applicability of this method



Appendix 3 P. 5

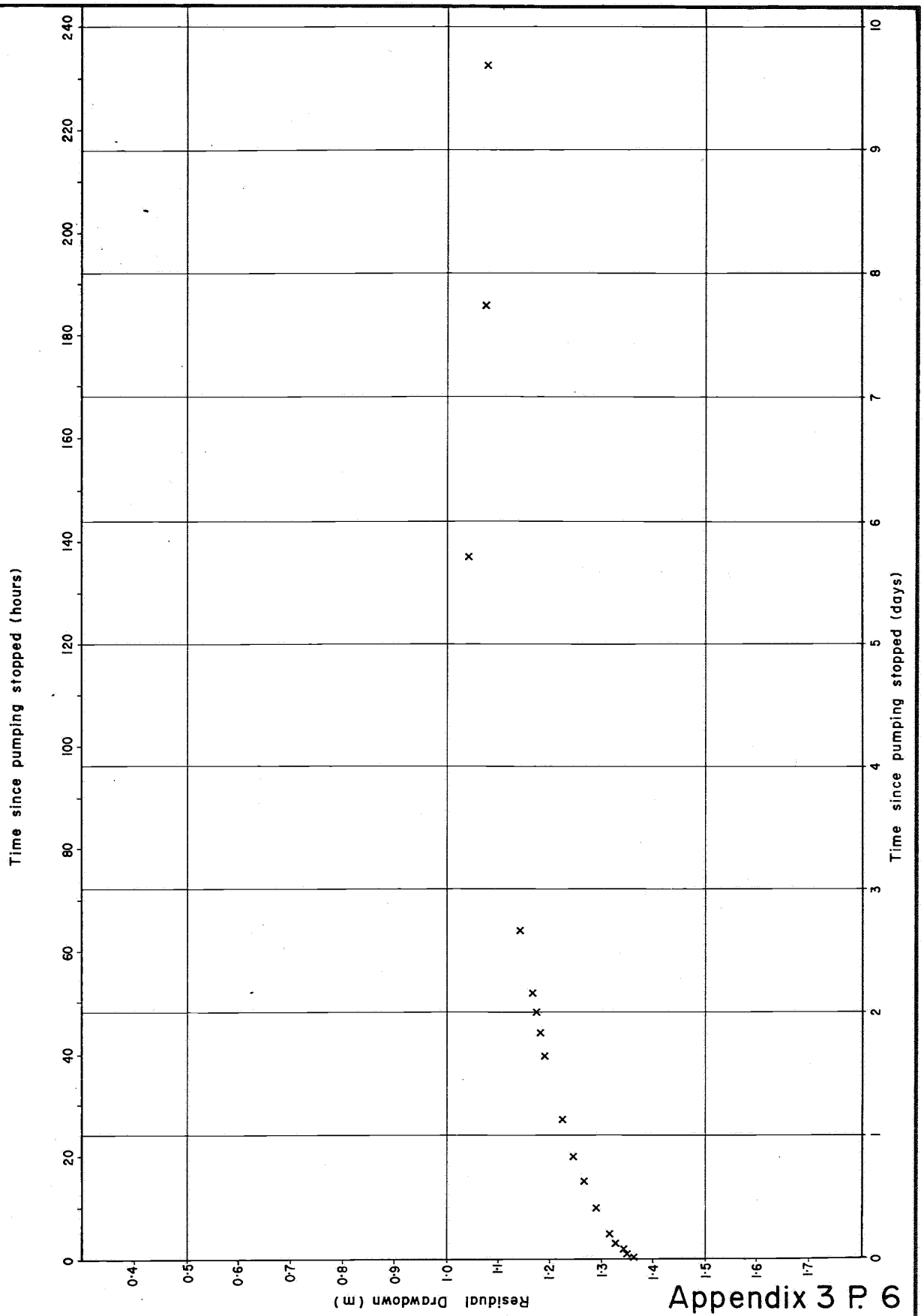
DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

MT MONSTER PORPHYRY DEPOSIT

WATER & STONE RESERVE No 1 · HD. STIRLING
PUMP TEST - DEWATERING PIT
DRAWDOWN Vs CUMULATIVE VOLUME PUMPED

COMPILED M. H. S.	CDO 14-1-82 DATE
DRAWN M. B.	SCALE
DATE 30-11-81	PLAN NUMBER S15981
CHECKED	

2485



Appendix 3 P. 6

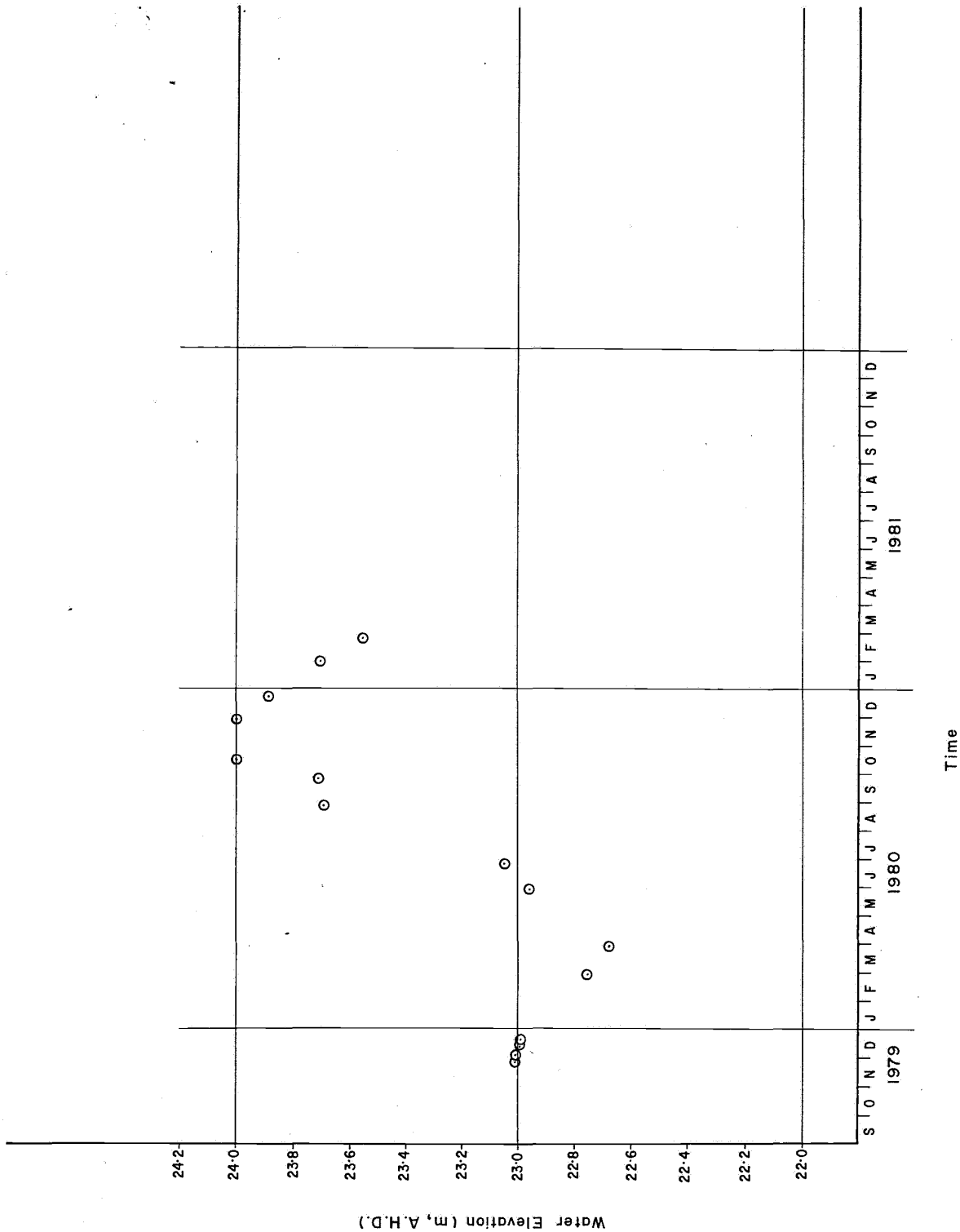
DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

MT MONSTER PORPHYRY DEPOSIT

WATER & STONE RESERVE Nº 1 · HD. STIRLING
PUMP TEST - DEWATERING PIT
RESIDUAL DRAWDOWN Vs TIME

COMPILED M. H. S.		CDO 14-1-82 DATE	
DRAWN M. B.		SCALE	
DATE 26-11-81		PLAN NUMBER	
CHECKED		S15982	

2465



Appendix 3 P. 7

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

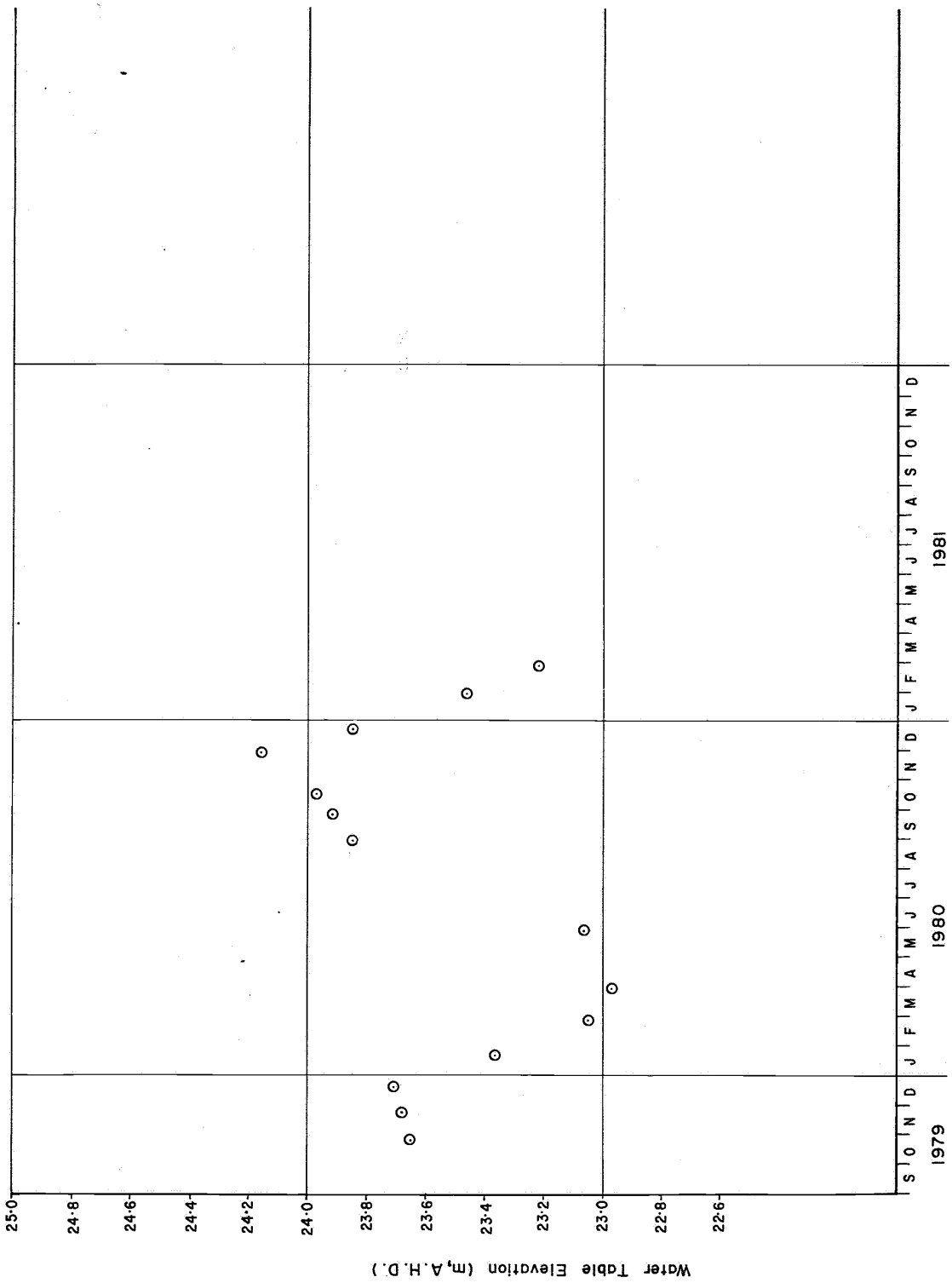
Mt MONSTER PORPHYRY DEPOSIT

WATER & STONE RESERVE Nº 1 · HD. STIRLING

FLUCTUATION OF WATER LEVEL IN DEWATERING PIT

COMPILED M.H.S.	C.D.O. 14·1·82 DATE
DRAWN M. B.	SCALE
DATE 26-11-81	PLAN NUMBER S15983
CHECKED	

2455



Appendix 3 P. 8

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

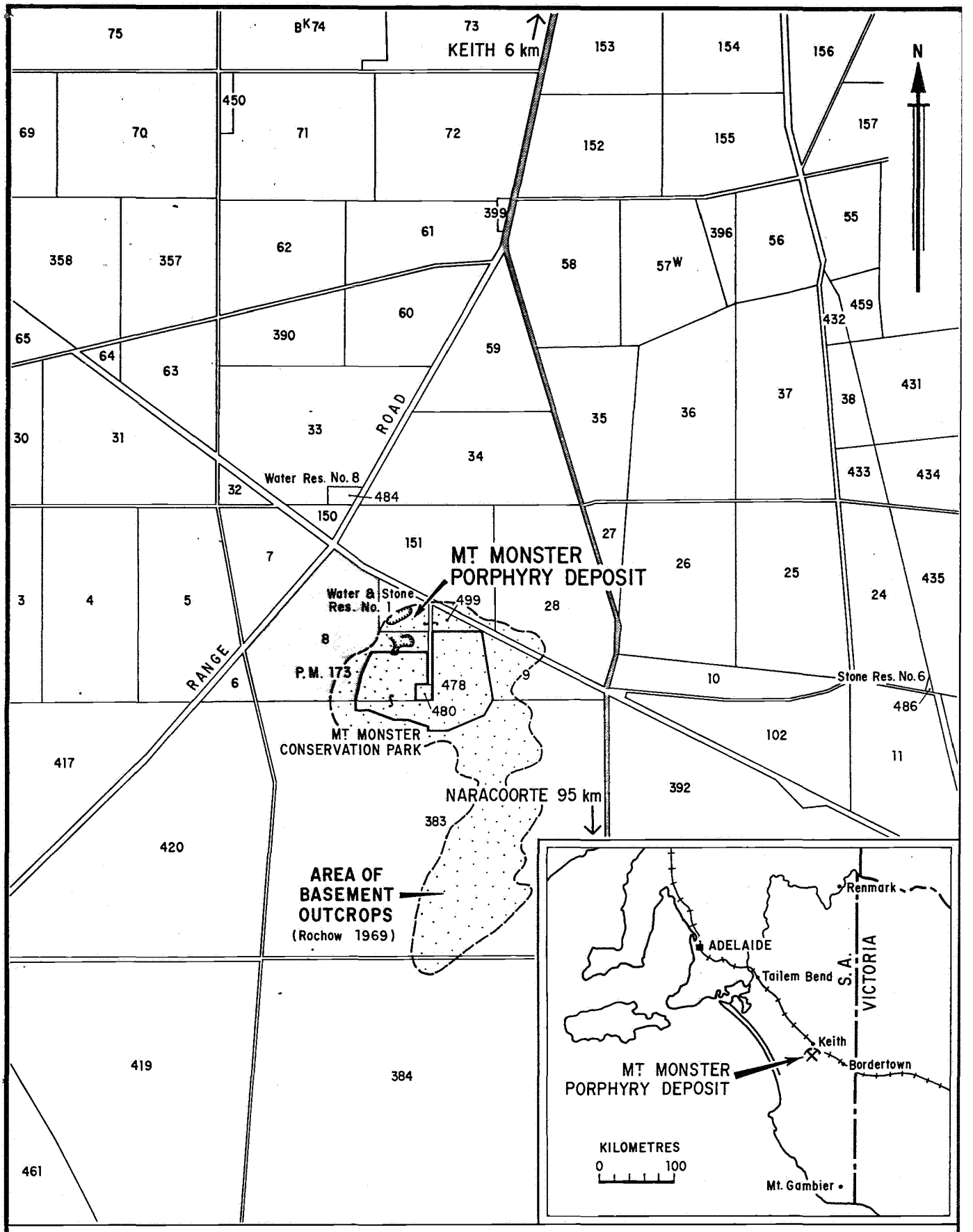
Mt MONSTER PORPHYRY DEPOSIT

WATER & STONE RESERVE Nº 1 · HD. STIRLING

FLUCTUATION OF WATER LEVEL IN WELL 6925-503

COMPILED M. H. S.	WR 14·1·82 C.D.O DATE
DRAWN M. B.	SCALE
DATE 26-11-81	PLAN NUMBER S15984
CHECKED	

2485



SCALE IN KILOMETRES

1 0 1 2 3 4

Fig. 1

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

COMPILED A.M.P. | CDO 14.1.82 DATE

MT MONSTER PORPHYRY DEPOSIT

WATER & STONE RESERVE Nº 1 • HD. STIRLING

LOCALITY PLAN

DRAWN N.R.S. | SCALE 1:50000

DATE 23-7-81 | PLAN NUMBER S 15629

CHECKED

2485

LEGEND

- Existing dump or quarry face.
- Proposed final quarry face.
- Auger drillhole and number.
- Strike and dip of jointing.
- Topographic contour in metres.
- Spot elevation in metres.
- Line of geological cross section.

NOTES

- Elevation datum A.H.D.
- For geological cross sections see Fig. 3 (81-516).

SCALE IN METRES

20 0 20 40 60 80 100

Fig. 2

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

COMPILED A.M.P.
DRAWN N.R.S.
DATE 23-7-81
CHECKED
C.D.D. DATE
SCALE 1:1000
PLAN NUMBER 81-515

Mt MONSTER PORPHYRY DEPOSIT

WATER & STONE RESERVE Nº 1 • HD. STIRLING

TOPOGRAPHIC PLAN AND
PROPOSED QUARRY DEVELOPMENT

2455

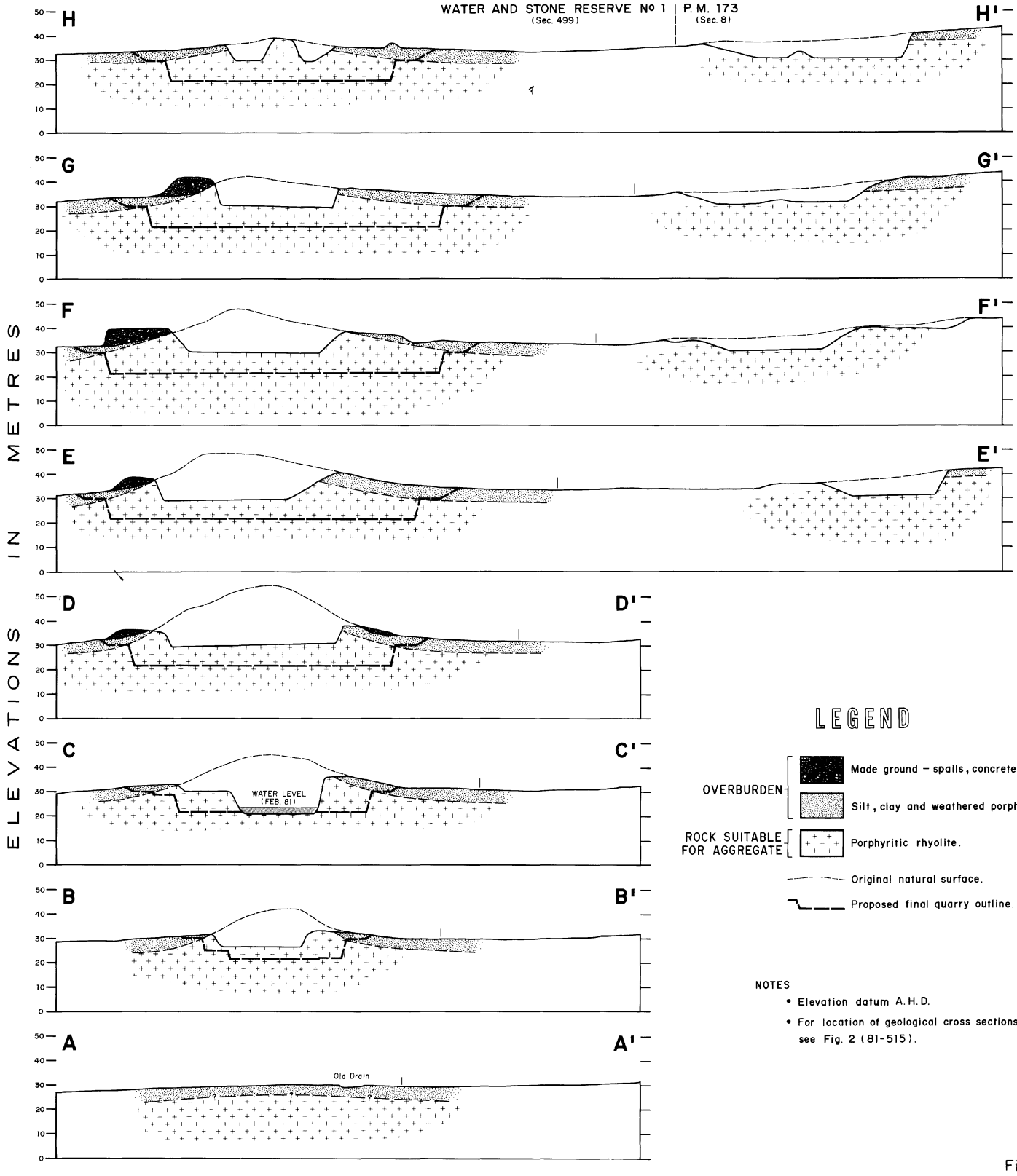


Fig. 3

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

Mt MONSTER PORPHYRY DEPOSIT

WATER & STONE RESERVE No 1 • HD. STIRLING

GEOLOGICAL CROSS SECTIONS AND PROPOSED QUARRY DEVELOPMENT

COMPILED	A.M.P.
DRAWN	N.R.S.
DATE	23-7-81
CHECKED	
C.D.O. DATE	14-1-82
SCALE	1:1000
PLAN NUMBER	81-516

2485

APPENDIX 5: PAIN ET AL. (1984), MINERAL RESOURCES REVIEW 154:46-53

Mount Monster and Papineau Rocks Aggregate Deposits

A.M. Pain, R.S. Robertson and C.M. Rosier

Ordovician porphyritic rhyolite and rhyodacite, at Mount Monster and Papineau Rocks respectively, are important sources of road sealing aggregate for the South-East of South Australia, being finer grained and more durable than other granitic rocks of the area. The rhyolite at Mount Monster has also been used as rail ballast.

Production from the two Mount Monster quarries totals 548 477 tonnes. Reserves at the larger quarry, within Water and Stone Reserve No. 1 controlled by the District Council of Tatiara, are estimated at 280 000 m³ of *in situ* rock beneath 70 000 m³ of overburden. When this has been quarried, an artificial lake 290 by 130 m and 1.5 to 2.5 m deep will be created which should provide an added attraction to the nearby Mount Monster Conservation Park.

Aggregate totalling 77 797 m³ was produced at Papineau Rocks during two crushing contracts for the Highways Department. Inferred reserves are 750 000 tonnes below 220 000 tonnes of overburden; a drilling program comprising two diamond-drillholes to 25 m and thirty rotary-percussion holes averaging 10 m is recommended to delineate overburden and prove these reserves. Additional rock may be available within 2 km of the quarry.

INTRODUCTION

An outcrop of porphyritic rhyolite north of Mount Monster, known locally as 'Little Mount Monster', was investigated as a source of road sealing aggregate and rail ballast by Johns (1951). Stone was first quarried from the site in 1955 and the last contract was completed in 1976. This is the most important source of road sealing aggregate and rail ballast in the Murray Mallee and Upper South-East of South Australia, being finer grained and more durable than medium to coarse-grained granites of the region (Rogers, 1980).

The two quarries on the deposit are north of the Mount Monster Conservation Park which was declared on 30 September 1976. Mount Monster has also been recognised as a geological monument (Toteff, 1979).

Stadia surveys of the quarry site were undertaken by SADME in November 1978 and November 1979. A pump test on surface water in the lowest (western) part of the quarry was carried out in November 1979 and three water samples were submitted to the E & WS laboratories for bacteria level determination because this part of the quarry is used as a swimming hole.

Papineau Rocks Quarry is the only current source of road aggregate near Kingston. Although the quarry has not been worked for fifteen years, screenings from the last crushing contract are still stockpiled in the area.

Papineau Rocks has been documented by Mawson and Parkin (1943), Mawson and Dallwitz (1944), Rochow (1971a), and Giles (1980). The main quarry was surveyed in 1980 and geologically mapped in December 1981. A number of other small volcanic outcrops have been discovered within 2 km of the quarry.

LOCATION AND TOPOGRAPHY

Mount Monster is a slightly elongate hill trending east-northeast, about 11 km south of Keith. The peak is about 80 m above sea level and 50 m above the surrounding plain.

The small quarry is situated on the northern slope of Mount Monster. The main quarry is 0.8 km north of Mount Monster on a subsidiary hill, known locally as Little Mount Monster, which has been almost entirely removed by quarrying (Fig. 1).

Access from Keith is southwards along the Keith to Naracoorte Road, turning southwestwards along Range Road 6.5 km south of Keith and then southeastwards after 3.5 km. The track into the quarry is to the south, 0.5 km from the second intersection.

Papineau Rocks is situated in uncleared land at the junction of the Ardune and Baker Ranges. Access is via the Kingston to Bordertown road to East Avenue Range then south near 'Keilira' along the Lucindale road for 8 km, then east near 'Shepherds Hill' for 7 km along an unsealed road. Total distance by road from Kingston is 41.5 km (Fig. 2).

MINERAL TENURE

The smaller (southern) quarry at Mount Monster is on PM 173 which covers section 8, hundred Stirling, county Buckingham. The main quarry is on Crown Land designated Water and Stone Reserve No. 1, control of which has been vested in the District Council of Tatiara since 1896. Both quarries are within the District Council of Tatiara in the Murray Mallee Planning Area.

Papineau Rocks Quarry, on section 237, hundred Minecrow, county Macdonnell in the District Council of Lacepede, part of the South-East Planning Area, is Crown land held under lease. Highways Department had access to construction materials under the Highways Act 1926-1975. MC 1601 was pegged over the deposit by Western Mining Corporation Ltd, and registered on 10 August 1982; Retention Lease 17 was granted for five years from 8 November 1983.

PRODUCTION

Production from the two quarries at Mount Monster is detailed in Table 1.

An estimated 214 000 m³ of *in situ* material have been removed from the quarry in Water and Stone Reserve No. 1, and 92 000 m³ from PM 173.

Two crushing contracts at Papineau Rocks produced a total of 77 797 m³ of sealing aggregate

Water ponded on the 21.5 m bench of the Mount Monster Quarry the view is easterly (March 1981). Negative 34330.

Southwesterly view of Quarry 1 at Papineau Rocks; the low salinity pool is used to water stock (June 1982). Negative 34331.

Table 1 *Aggregate production, Mount Monster*

Year	Tonnes
1955	32 363
1956	26 926
1967	47 367
1968	33
1971	119 826
1972	160 670
1973	108 283
1975	52 625
1976	384
Total	548 477

for the Highways Department in 1958/59 and 1966/67 as detailed in Table 2. Four quarries were developed over an area of approximately 220 by 80 m; most of the production was from Quarry 1 (Figure 2).

Table 2 *Aggregate production, Papineau Rocks*

	Crushing Contract No. 1 1958-59	Crushing Contract No. 2 1966-67
Product (mm)	m^3	m^3
Screenings 15.9-9.5	26 296	15 794
Screenings 9.5-4.8	9 557	7 930
Screenings 6.3-2.4	12 679	5 541
Total	48 532	29 265
Sand by-product	not recorded	8 824

Total screenings from both contracts: 77 797 m^3

GEOLOGICAL SETTING

The regional geology is shown on NARACOORTE (Rochow, 1969). Rocks at Mount Monster and Papineau Rocks are part of a suite of Ordovician granites and volcanics which crop out along a northwesterly trending Cambrian basement high known as the Padthaway Ridge. The rocks range in composition from soda rhyolite to soda-potash granite.

Pleistocene Bridgewater Formation covers much of the Padthaway Ridge and forms low northwesterly trending calcarenite dune ridges. These are separated by narrow interdunal plains with occasional swamps underlain by swamp and marsh deposits of silt and clay with localised peat accumulations. Small unconsolidated sand dunes with an easterly trend have developed over the calcarenite dunes.

SITE GEOLOGY

Mount Monster

The quartz-feldspar porphyry is comprised of a dark red-brown aphanitic groundmass of quartz and feldspar enclosing subhedral to euhedral potash feldspar and plagioclase phenocrysts up to 10mm, and rounded smoky quartz grains. Petrographic descriptions are presented in Pain and Robertson (1982).

The most prominent joint set in the main quarry trends 065°, parallel to the length of the quarry (Fig. 1). Dip is approximately 75° southeast and spacing is about 0.2-1.0 m. Subsidiary joint sets are:

- strike 005°, dip 80° east
- strike 340°, dip 75° northeast
- strike 300°, dip 60°-85° northeast.

Overburden comprises weathered kaolinitic porphyry, clay with rock fragments, brown sandy clay, silty soil, and patchy calcrete. In the main quarry, overburden thickness varies from nil on the northern face to 5 m on the southern face.

Papineau Rocks

Fresh rock exposed in the quarries is a fine-grained dark grey-green volcanic containing typically 10-20 per cent scattered feldspar phenocrysts up to 1.5 mm set in a fine, devitrified groundmass containing plagioclase, potash feldspar, quartz, chlorite and opaques. Epidote is a common accessory mineral.

An irregular structure defined by elongated chloritic patches and plagioclase laths is discernible in thin section and in quarry faces. Henstridge (1970) suggested that the rock is a flow breccia. Giles (1980) surmised that the rock could be a welded tuff exhibiting compaction banding textures. The rock has previously been referred to as a rhyolite by Henstridge (1970) and Rochow (1971b). Nine samples examined by AMDEL were found to be mostly dacitic in composition. Petrographic descriptions are included in Rosier and Pain (1982).

Two prominent joint sets, with near vertical dips and striking approximately north-south and east-west, are developed in Quarry 1. These constitute the only apparent major planes of weakness, as the rock shows little evidence of preferred breakage along flow banding or annealed joints.

Weathering is patchy and unpredictable, the degree varying from slight to extreme. The most highly weathered material has the appearance and material properties of very soft friable red-brown silt. Maximum observed depth of weathering exceeds 10 m in the southern face of Quarry 4.

Calcreted calcarenite of Pleistocene Bridgewater Formation crops out to the northeast of the quarry area. Small scattered outcrops of slightly weathered rhyodacite protrude through this material within 100 m east of Quarry 4.

MATERIAL QUALITY

Mount Monster

Results of aggregate testing by the Highways Department are summarised in Table 3. All Los Angeles abrasion test (LA) results are within contract specifications for road aggregate. The material is reported to have adequate bitumen affinity.

Papineau Rocks

Results of product testing by the Highways Department are summarised in Table 4. Of particular interest are the LA results which, with losses averaging only 14.2 per cent, indicate the material has very high abrasion resistance; specified LA losses for sealing aggregate are less than 25 per cent.

Table 3 *Aggregate testing, Mount Monster*

Test	No. of samples	Results	
Los Angeles abrasion			
Product size (mm)		Average loss(%)	Stand. dev.
15.9-9.9	22	16.8	0.05
9.5-6.4	20	17.5	0.69
Sulphate soundness			
Product size (mm)		Loss (%)	
38 -9.5	1	0.5	
Crusher sand	1	1.7	
19 -9.5	1	0.5	
9.5-4.7	1	1.4	
Shape			
Product size (mm)		Flakiness index (%)	Elongation (%)
19 -6.4	1	19	29
9.5-6.4	1	33	42
Plasticity index and linear shrinkage			
Product size		Plasticity index	Linear shrinkage
Crusher sand	1	1	0.1
Crusher sand	1	2	0.2

Table 4 *Aggregate testing, Papineau Rocks*

Test		No. of samples	Results							
Los Angeles abrasion										
Product size (mm)			Average loss (%)				Range			
Spalls	38.1	1	12.0				—			
	25.4	1	12.0				—			
Chippings	19.1-15.9	4	13.8				13-14			
	15.9- 9.5	42	13.0				11-16			
	9.5- 4.8	35	15.9				13-21			
Sand	6.3- 2.4	2	14.0				12-16			
Average least dimension										
Product size (mm)			Average (mm)				Range			
Chippings	15.9- 9.5	18	7.4				0.20-0.33			
	9.5- 4.8	11	4.8				0.17-0.21			
Sand	6.3- 2.4	4	4.1				0.16-0.17			
Liquid/plastic limits, plasticity index, linear shrinkage										
Product size (mm)			L. limit (%)		P. limit (%)		P. index		L. shrink.	
			Avg.	Range	Avg.	Range	Avg.	Range	Avg.	Range
Chippings	19.1-15.9	4	26.6	24.5-28	15.8	15 -17	10	8-13	5	4 -6
	15.9- 4.8	18	22.3	16.8-28	16	11.9-19	6.2	3-14.6	2.8	5 -1.5
Sand	6.3- 2.4	4	25.6	23 -28	16.8	13 -19	8.8	4-14	4.8	4 -6
Crusher dust		8	16.5	11 -17	15	14 -16	1.8	1- 2	0.5	0.1-0.8
Specific gravity										
Product size (mm)			Apparent		Saturated surface dry		Bulk		Water absorp. (%)	
Spalls	38.1	1	2.68		2.66		2.65		0.37	
Chippings	19.1-15.9	1	2.69		2.64		—		1.0	
	15.9- 9.5	2	2.68		2.65		2.63		0.75	
Sand	6.3- 2.4	2	2.63		2.58		2.55		1.12	
Shape and sulphate soundness										
Product size (mm)			Flakiness (%)		Elongation (%)				Sulphate soundness (%)	
Spalls	38.1	1	—		—				1.0	
Chippings	15.9- 9.5	1	40		43				8.3	

QUARRY DEVELOPMENT AND RESERVES

Mount Monster

Water and Stone Reserve No. 1

The quarry is 270 by 100 m and 24 m below natural surface. Benches have been developed at levels of 40, 30 and 21.5 m AHD. The lowest point, at RL 20.7 m, is on the floor against the northeastern face.

The screening plant and main scalps dump, 100 m north of the quarry, cover about one hectare. No aggregate stockpiles remain on site.

Seven holes totalling 12.25 m were drilled in March 1981 using a SADME truck-mounted power auger. The holes were sited as shown on Figure 1 to determine overburden depths adjacent to the

southeastern face of the main quarry, but stiff clay and rock fragments prevented penetration to fresh rock. Drillhole logs are presented in Pain and Robertson (1982).

The following three options were considered for future development of the quarry:

1. Rehabilitate the quarry by blasting down the faces and backfilling the 21.5 m floor and eastern part of the 30 m bench, where water ponds during winter months, to provide a dry floor.
2. Maximise the aggregate yield by widening the quarry and developing one bench below the existing deepest point at RL 20.7 m. A permanent body of water approximately 250 by 80 m and 16 m deep will result.

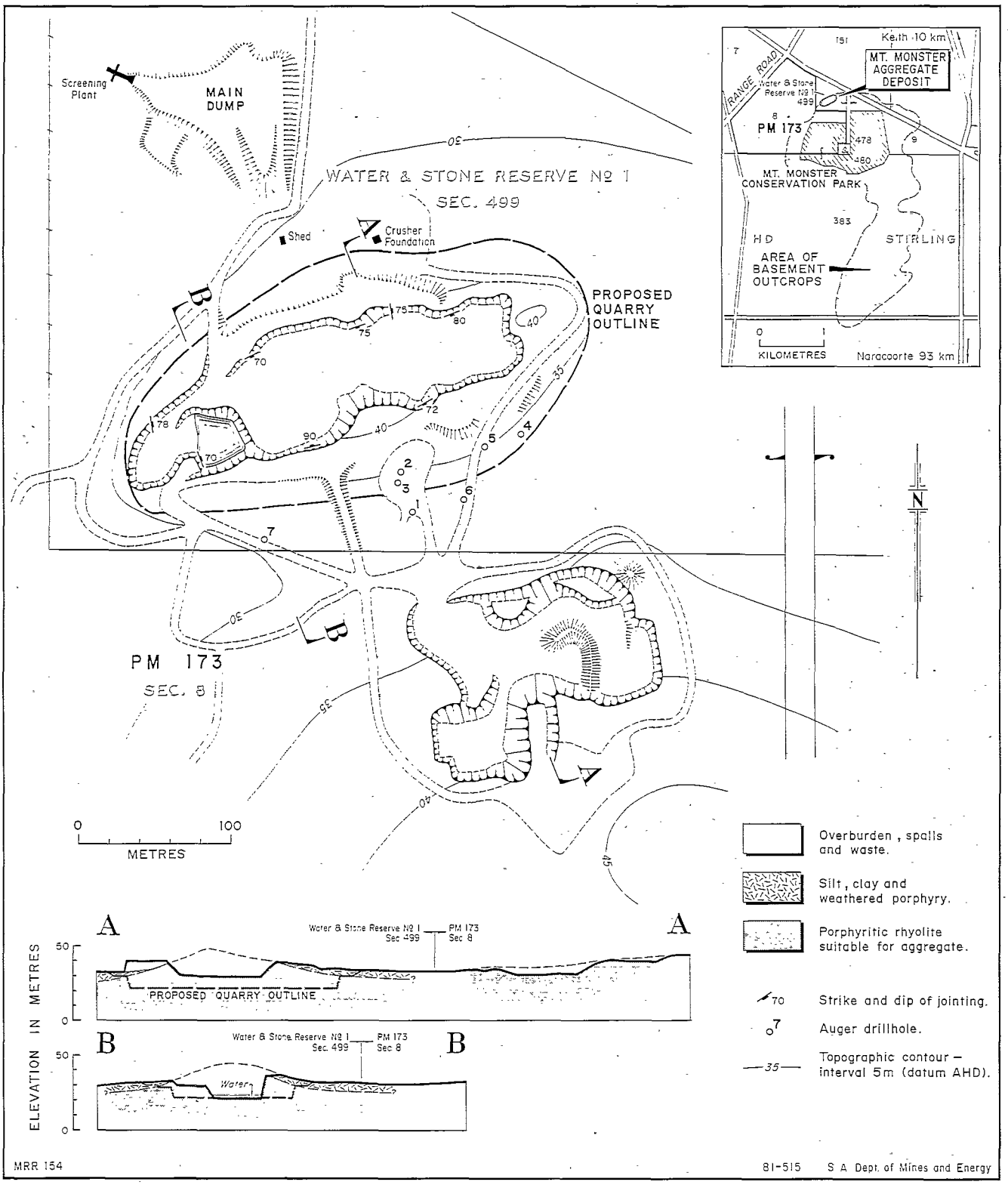
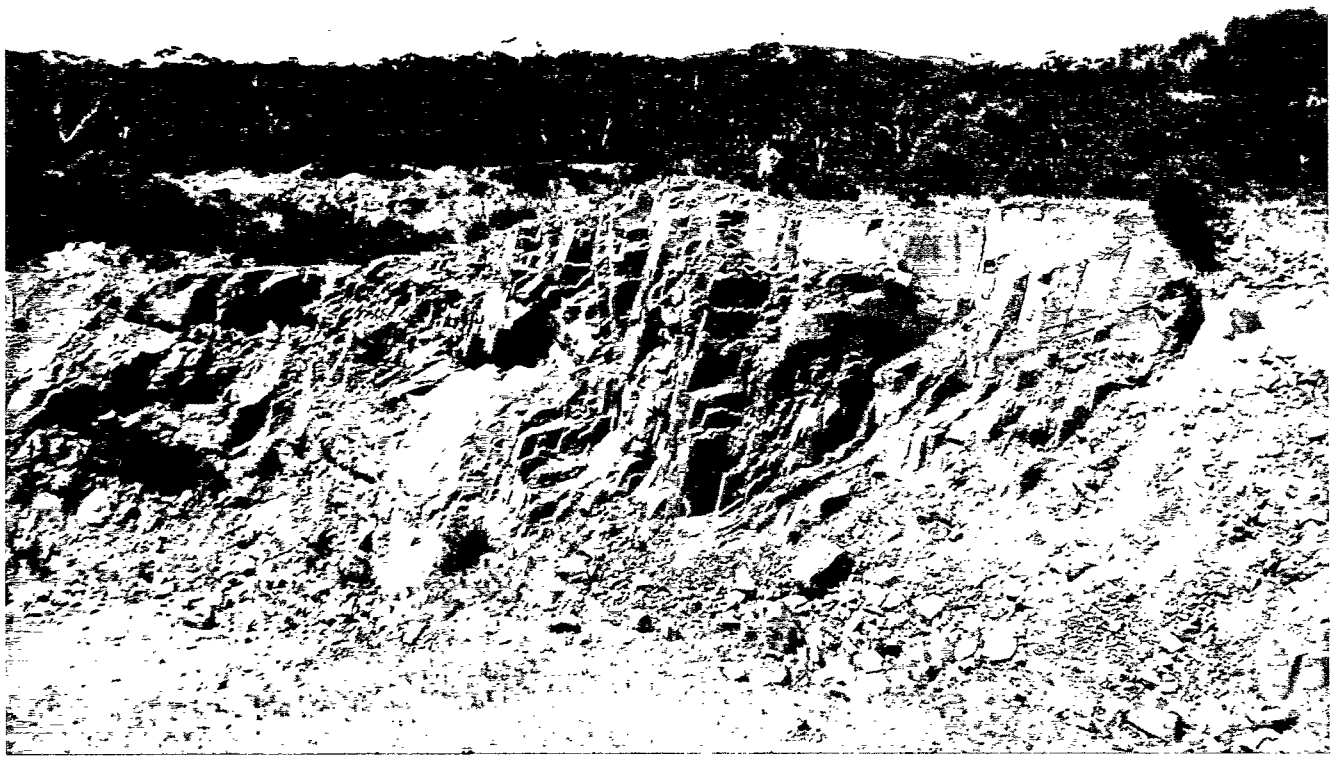


Fig. 1 Plan and geological sections, Mount Monster Quarry.



Southerly view of Mount Monster Quarry with the smaller quarry and conservation park in the background. Light coloured overburden of weathered kaolinitic porphyry in the face has a maximum thickness of 5 m (March 1981). Negative 34332.

3. Widen the quarry and deepen overall to the 21.5 m level. A permanent body of water will result, fluctuating between 1.5 m deep in summer and 2.5 m in spring.

Option 3 is considered the most appropriate as Option 1 will sterilise a valuable resource and Option 2 will result in a deep body of water which may be considered dangerous, particularly in an area readily accessible to the public.

Proposed development using Option 3 is shown on Figure 1. Yield will approximate 280 000 m^3 of *in situ* rock below 70 000 m^3 of overburden.

The final faces should be blasted and quarry sand and scalps dumped around the lake shore to form an artificial beach. Final lake dimensions will approximate 290 by 130 m. There are adequate quantities of scalps available and more will be produced with further crushing.

Pump Testing

Pump testing of the main quarry was undertaken in November 1979 to determine the feasibility of dewatering and working below water level. Results of the test (see Pain and Robertson, 1982) indicated that groundwater inflow is small and quarrying could be carried out beneath the water table provided the limestone aquifer in contact with the quarried material is not exposed.

Water Quality

Samples of water taken at three random sites from the quarry were found by the E & WS Department to be suitable for swimming but not for drinking.

Private Mine 173

The quarry is 150 by 130 m and 12 m below natural surface. The pit floor is approximately at RL 30.7 m, with remnants of an upper bench at 34 m.

Further development is not warranted because of the thickness of overburden in the southern faces. The quarry should be rehabilitated during the next crushing contract in the main quarry by placing spalls against the faces and covering with overburden.

Papineau Rocks

The next stage of quarrying should develop the area to the northeast of the present workings as outlined on Figure 2.

Overburden comprises material dumped from previous crushing contracts, weathered rhyodacite, and patchily calcreted calcarenite of the Bridgewater Formation. Calcarenite is used extensively in construction of unsealed roads throughout the South-East of the State and some of the overburden may prove satisfactory for this purpose.

Depth of overburden is variable and unpredictable. A program of thirty vertical rotary-percussion drillholes averaging 10 m is recommended to define overburden depth at sites shown on Figure 2. Two vertical diamond-drillholes to 25 m are also recommended, 23 and 75 m northeast of Quarry 2 (Fig. 2).

Dewatering of Quarry 1 is not expected to present major problems, the fresh rock having very low

permeability. However, runoff from rainfall and localised perched water tables which are likely to be encountered may necessitate minor dewatering during the next phase of quarrying.

In view of:

- the importance of the quarry as a source of stock water
- the likelihood that dewatering will be relatively simple in future operations
- the infrequent and short duration of future quarrying operations,

the quarry should not be made free-draining, and operations at the southern and eastern sides of the quarry should be restricted to maintain a lip of at least RL 32 m to ensure a continuing supply of stock water from the site between quarry operations.

Assuming an average overburden thickness of 5 m, approximately 750 000 tonnes of fresh rhyodacite should be available to RL 30 m beneath 220 000 tonnes of overburden in the area outlined on Figure 2. These quantities should be confirmed by drilling. Additional material may be available

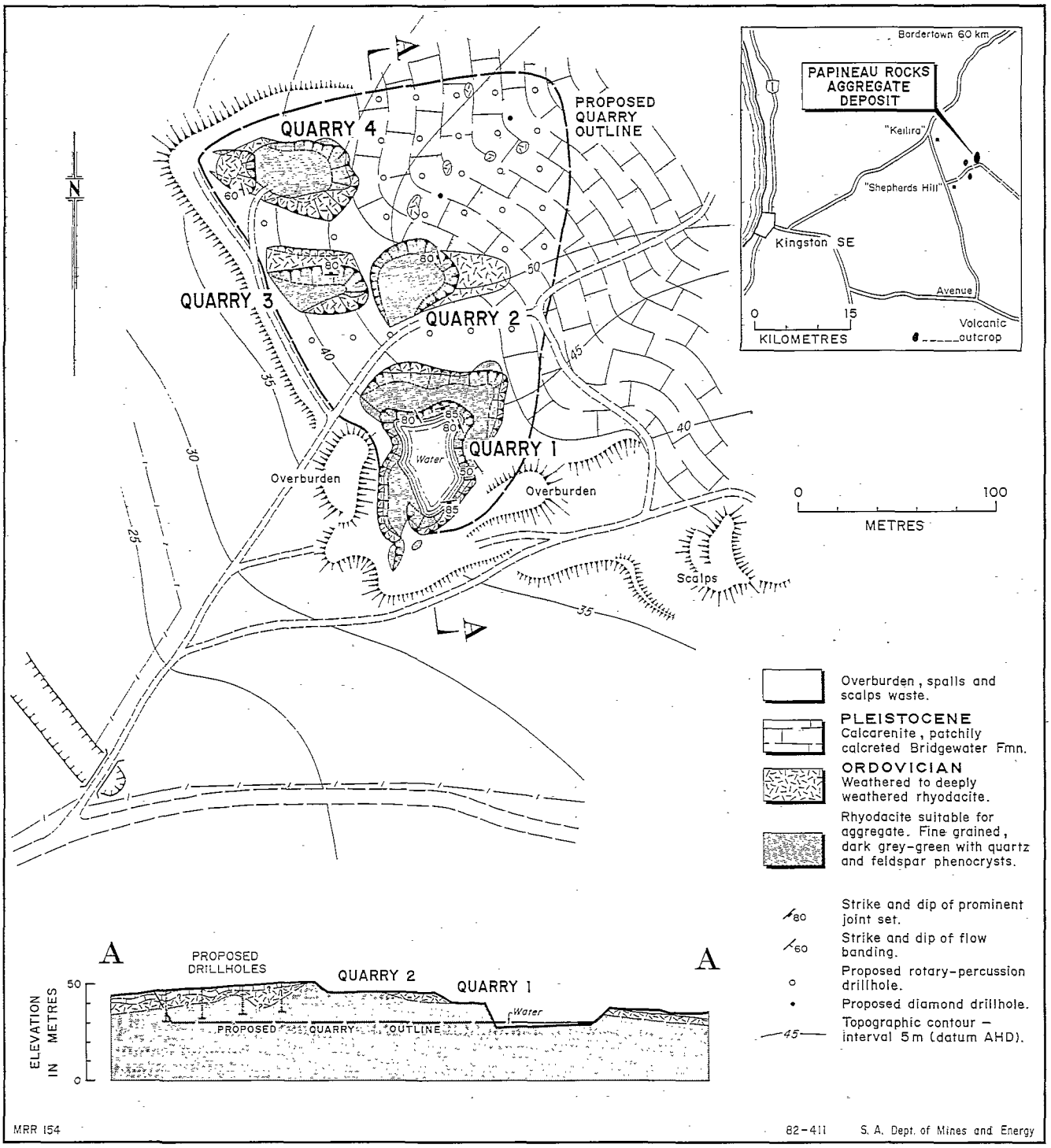


Fig. 2 Geological plan and section, Papineau Rocks Quarry.

beneath thicker overburden to the east of the designated area.

Two other outcrops of rhyodacite within 2 km as shown on Figure 2 should be investigated by geological mapping and drilling.

CONCLUSIONS AND RECOMMENDATIONS

By widening the quarry in Water and Stone Reserve No. 1 at Mount Monster and extending the floor to RL 21.5 m, 280 000 m^3 of rock will be available with removal of 70 000 m^3 of overburden. Although the quarry will have to be pumped dry before operations recommence, inflow of groundwater will be slow and easy to control. At the end of operations, the abandoned quarry would be expected to fill with water to a depth of approximately 1.5 to 2.5 m.

As the quarries and adjacent Mount Monster Conservation Park are already a popular picnic site, an artificial lake will further enhance the area for recreation.

Rehabilitation of the abandoned quarry on PM 173 should be carried out during the next crushing contract in the main quarry.

Preparation of a detailed rehabilitation program by SADME, in consultation with the District Council of Tatiara and the Department of Environment and Planning, is recommended.

At Papineau Rocks, an estimated 750 000 tonnes of rock suitable for production of high quality road sealing aggregate are inferred to underlie 220 000 tonnes of overburden comprising waste from previous crushing contracts, weathered rhyodacite and patchily calcreted calcarenite.

A program of thirty rotary-percussion drillholes averaging 10 m and two diamond-drillholes to 25 m are recommended to define overburden limits and prove reserves before commencement of further quarrying operations. Nearby rhyodacite outcrops should be evaluated before depletion of reserves at this site.

The quarry floor should not be made free-draining as water ponded between crushing contracts is used by stock.

(Compiled from Pain and Robertson, 1982, and Rosier and Pain, 1982).

REFERENCES

Giles, C., 1980. Papineau Rocks. In: McBriar, E.M. and Mooney, P.A. (Eds.), Geological monuments in South Australia, Part 3. Geol. Soc. Aust., pp.48-50 (unpublished).

Henstridge, D.A., 1970. The petrology and geochemistry of the Upper South-East Granites, South Australia. University of Adelaide B.Sc. hons. thesis (unpublished).

Johns, R.K., 1951. Granite deposit—Mount Monster. S. Aust. Dept. Mines report 31/76 (unpublished).

Mawson, D. and Dallwitz, W.B., 1944. Palaeozoic igneous rocks of lower southeastern South Australia. *Trans. R. Soc. S. Aust.,* 68:191-209.

Mawson, D. and Parkin, L.W., 1943. Some granitic rocks of southeastern South Australia. *Trans. R. Soc. S. Aust.,* 67:233-243.

Pain, A.M. and Robertson, R.S., 1982. Mount Monster porphyry deposit near Keith, Murray Mallee—geological investigations 1978-81. S. Aust. Dept. Mines and Energy report 81/112 (unpublished).

Rochow, K.A., 1969. NARACOORTE map sheet, *Geological Atlas of South Australia,* 1:250 000 series. Geol. Surv. S. Aust.

Rochow, K.A., 1971a. Geology of the NARACOORTE 1:250 000 sheet. S. Aust. Dept. Mines report 71/25 (unpublished).

Rochow, K.A., 1971b. The Padthaway Ridge. *In:* Wopfner, H. and Douglas, J.G. (Eds.), *The Otway Basin of Southeastern Australia.* Spec. Bull. geol. Survs. S. Aust. Vict., pp.325-337.

Rogers, P.A., 1980. *Geology of the South East, South Australia, Geological Atlas Special Series,* 1:500 000 Geol. Surv. S. Aust.

Rosier, C.M. and Pain, A.M., 1982. Papineau Rocks rhyodacite aggregate quarry—geological investigations. S. Aust. Dept. Mines and Energy report 82/99 (unpublished).

Toteff, S., 1979. Mount Monster. In: Toteff, S. and McBriar, E.M., Geological monuments in South Australia, Part 2. Geol. Soc. Aust., pp.80-82 (unpublished).

APPENDIX 6: GEOLOGICAL MONUMENTS IN SOUTH AUSTRALIA PART 2

Edited by S. Toteff (1979)
Geological Society of Australia

Copy No. 5

GEOLOGICAL MONUMENTS

IN

SOUTH AUSTRALIA

PART II

Edited by S. Toteff and E.M. McBriar
on behalf of
the Geological Monuments Subcommittee
of the S.A. Division of the
Geological Society of Australia Incorporated

February, 1979

This report was produced under a grant from the National Estate Programme 1977/78 made available by the Commonwealth of Australia through the Australian Heritage Commission.

GEOLOGICAL SOCIETY OF AUSTRALIA INC.
SOUTH AUSTRALIAN DIVISION

FILE NO. MM.7 - MOUNT MONSTER

Item: The Mount Monster porphyry.

General description and precise locality

Mount Monster is a slightly elongate hill trending ENE which lies approximately 11 km south of Keith. The rounded peak is 80 m above sea level and approximately 50 m above the surrounding plains. It has a gentle slope and rock outcrops are mainly restricted to the upper levels of the hill. The poorly developed tors are commonly less than a few metres in height although some larger masses occur near the summit and on a small peak just to the west.

Most outcrops are subdued rounded mounds covered largely by moss and lichen. The nature of the rock is best seen in the quarry 0.5 km north of the summit where a subsidiary hill (Little Mount Monster) has been almost entirely removed as a source of road metal.

Native scrub covers the Mount Monster area but little remains elsewhere in the district. Much of this scrubland is within the recently declared Mount Monster Conservation Park.

The area is within the Hundred of Stirling. Grid reference of Mount Monster is 140°19'E, 35°12'S.

Access

Access from Keith is south along the main Keith-Naracoorte road. Approximately 6.5 km south of Keith, turn right along Range Road. Turning left after 3.5 km (the first intersection) proceed for 0.5 km. On the right is a track where a sign indicates access to the Mount Monster Conservation Park. This track passes through the quarry area and can be negotiated to within 150 m of the summit.

Geological interest

General

The igneous rocks of Mount Monster are of Lower Palaeozoic age and superficially appear unlike most of the other igneous rocks in the Upper South East. Their textures, however, are very different. The rocks of Mount Monster are genetically related to the granites of the Coonalpyn-Tintinara area and the Dergholm Granite of southwest Victoria.

Detailed geology

The Lower Palaeozoic igneous rock of the Mount Monster area is a quartz-feldspar porphyry. The aphanitic groundmass of quartz and feldspar is a dark red-brown colour. Large phenocrysts consisting of subhedral to euhedral pink-orange potash feldspar, pale green plagioclase and rounded smoky quartz are clearly visible in hand specimen.

The feldspars (to 1 cm) are predominantly perthitic potash feldspar although non-perthitic crystals are present. Accessary minerals include epidote, sphene, calcite and fluorite.

In the quarry a slight preferred orientation of phenocrysts can be seen in hand specimen; this is probably the result of flow-banding. Fine secondary fluorite and epidote occur along joints and fractures.

Weathering usually extends to a depth of over 1 m along joints and fractures. A pale pink to yellow weathered skin up to 1 cm in depth is common.

The porphyry belongs to the same suite as the granites of the Upper South East and the Dergholm Granite of southwest Victoria. It is believed that the porphyry is a close-surface equivalent of the granites. There is a possibility that the rock may indeed be of extrusive origin (Henstridge, 1970).

State of preservation

The Mount Monster Conservation Park is in an excellent state of preservation. Quarry operations at Little Mount Monster have ceased for the present and the deeper excavations are filled with water. A stockpile of gravel remains on the northern side of the quarry which is within a stone reserve. This is crown land (approximately 25 hectares) which is managed by the District Council of Tatiara.

Within the 80 hectare park there is little evidence of misuse except for damage to a plaque (erected in 1976). The tors have not been defaced. Damage to flora by off-road vehicles is a possibility if restrictions are not clearly displayed at the entrance.

Recommendations

As the quarry is of considerable geological interest and enclosed by native scrub, this land (the entire stone reserve) would be a logical addition to the Mount Monster Conservation Park once stone extraction has finished. As there is an obvious lack of native vegetation in the Keith district, it is desirable to acquire the rare belt of scrub (approximately 30 hectares of freehold land) which lies immediately to the east of the park. This possibility should be brought to the attention of the Nature Conservation Society of South Australia.

References

Henstridge, D.A. (1970): The petrology and geochemistry of the Upper South East granites, South Australia. B.Sc. (Hons.) thesis, Univ. Adelaide (unpublished).

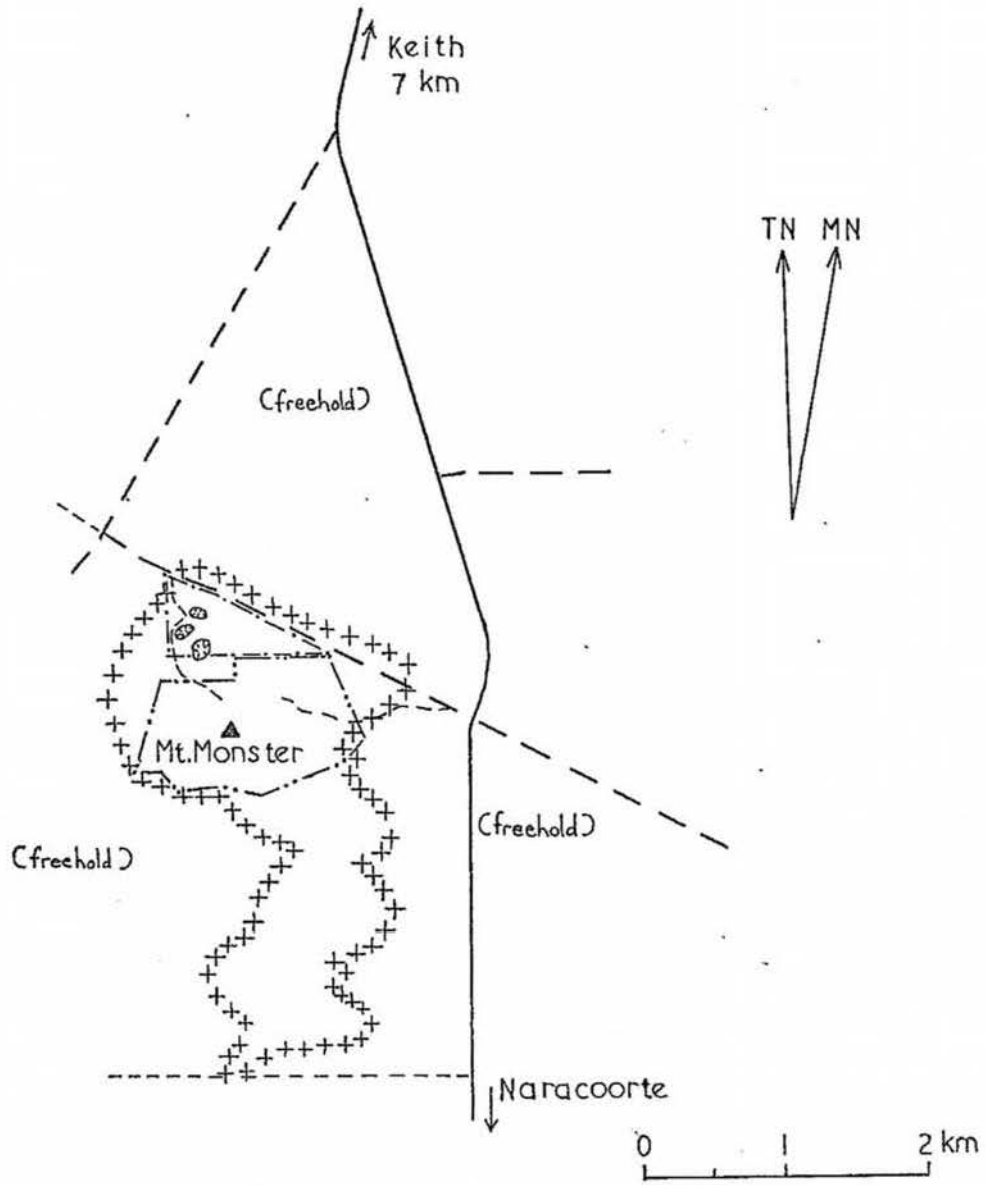
Mawson, D., and Dallwitz, W.B. (1944): Palaeozoic igneous rocks of Lower South-Eastern South Australia. *Trans. R. Soc. S. Aust.*, 68(2), 191-209.

Mawson, D., and Segnit, E.R. (1945): Porphyritic potash-soda microgranites of Mount Monster. *Trans. R. Soc. S. Aust.*, 69(2), 217-222.

- S. Toteff -

MOUNT MONSTER AREA

FILE MM 7



+++ SURFACE LIMITS OF PORPHYRY (After Henstridge, 1970)

—·—·— STONE RESERVE BOUNDARY

—··— CONSERVATION PARK BOUNDARY

——— MAIN ROAD

— — — MINOR ROAD

- - - - - TRACK

⊗ QUARRY

S.T.78

FILE NO. MM.7

(a) View of Mt. Monster summit looking east.

(b) Disused quarry at the site of Little Mt. Monster.

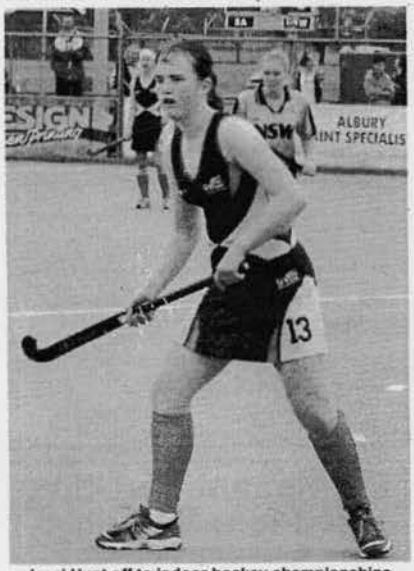
APPENDIX 7: NEWSPAPER ARTICLES FROM BORDER CHRONICLE

Mount Monster meeting	2 December 2004
Letter to the Editor	
Opposed to mining parkland	October 2005
Mining issues resurface	October 2005
Mount Monster limbo	24 November 2005
Mount Monster land sale complicated	24 November 2005
State wants to buy all of Mount Monster	19 January 2006
Council call to add land to Mount Monster	12 October 2006

were invited to attend tryouts for the South Australian Indoor Hockey junior teams held in Adelaide at The Super Dome. Unfortunately Brett had other commitments and did not attend.

Jessi Hunt put in a fine effort with her bid for state selection and was notified of Jessi has played only one season of ndoor Hockey with Mundulla but her outdoor experiences gave her a good stepping stone.

Jessi will be representing SA in the Under-16 Indoor Championships for 2005 in Woolongong NSW from January 10 - 13.



Jessi Hunt off to indoor hockey championships.

STRATEGIC PLAN

The CEO, Mr Harkness included some comments on the Strategic Plan in his November report. He said that a number of community organisations and larger businesses had been invited to comment on Council's Strategic Management, but at that point he had only received a list from Cr Davis of items needing to be included in the plan.

These were—

1. Better water allocation to lift fat lamb production and to support the establishment of a cheese factory.

CEO's comment: Increased water allocation is not under councils control but we can advocate for increases.

2. Bypass Lanes should be added on Meatworks Road and Pigeon Flat intersection as well as Cannawigara Road/ Meatworks Road intersection as these are very dangerous corners.

CEO's comment: Council could add a target to improve safety on all council roads including Meatworks Road.

3. We have bad soil erosion in our district which badly needs attention.

CEO's comment: Council has a number of roads with sand erosion problems. Sand erosion on private property is not under our control but we could advocate for increased grant funding and clauses to cover this could be included in the plan.

4. Over the town, the footpaths are very average.

CEO's comment: We have some very poor footpaths and this is recognised in the plan under infrastructure stating:

- Undertake an audit and condition assessment of footpaths;
- Develop and maintain 5 year roads and footpath plan.

This could be strengthened in the plan to state "council will allocate funds in the road works budget for the next five years to improve the condition of the footpaths.

5. The 3 R's – Roads, Rates and Rubbish – will never go away.

CEO's comment: The 3 R's are covered in the SMP.

6. Wetlands need fencing to reduce fire hazard.

CEO's comment: Probably not needed to be included in long term plan as if deemed a priority could be fixed by allocating funds in budget.

7. Tatiara Creek to Poocher – needs to be completely redesigned.

CEO's comment: Council is working on improving the creek from Pigeon Flat Road back into the town. West of Pigeon Flat Road, the creek is controlled by SE Water Conservation and Drainage Board. CEO said he was not aware of any major problems in this section.

The CEO made the general comment that council can add or delete whatever it wants as the plan belongs to council, not staff.

All councillors have had opportunity to submit comments but few have done so.

Mr Harkness said "If you are happy with this plan, then we need to adopt it. If you are not happy, then we need to alter it to what you want and then adopt that. It is this plan that staff will be working to implement over the next 12 months and longer."

Mr Harkness made further comment that along with Cr Vickery, he had attended a State Government workshop on the State Strategic Plan.

The main message of the day is that we all need to get behind the plan and ensure that the objectives in the plan are met.

So before council adopts their plan they need to check the 79 targets in the state plan and see that they are in essence included in TDC plan. Consequently the adoption of this plan could be delayed for a month.

KEITH INDUSTRIAL ESTATE

All the allotments in Stage 1 of the Keith Industrial Estate have now been sold, with allotments 10 and 11 having been recently sold with settlement scheduled for January 31, 2005.

A budget allocation has been made to prepare plans and lodge a land division application in this financial year.

The land where stage 2 will be developed is leased until June 30, 2005 so any infrastructure development is unlikely to take place until after that time.

Mr Callisto said that currently discussions are taking place with a developer who may be interested in purchasing quite a large portion of the second stage of the Industrial Estate. He said that plans will not be finalised until the developer makes a decision as that could influence the land development design.

Cr Stanbury asked that with funds in the budget but the land leased to 2005, what is the time frame for stage 2.

Mr Callisto said that the leasing would not significantly hold up the development as the land planning and land division was likely to take 6 months. Even if the development of stage 2 was done in stages, it would still be likely to be another 6-7 months.

HACC PROGRAM

In October, Cr McLellan successfully moved that council request information regarding how the HACC funding was spent in the Tatiara.

In November a response was received from Sharon Kelly, South East Regional Community Health Services.

Ms Kelly repeated her thanks for having been able to attend council and speak on the service on September 14 – and she gave the information that HACC program provides services for the frail aged and disabled members of the community. These services vary and can include home cleaning, socialisation, opportunities, personal care and maintenance services.

In the Tatiara, the services are available and after clients have been accessed they are provided with services appropriate to their requirements, Ms Kelly said.

She said funding for these services related to the Tatiara was a $130,000 recurrent allocation. A total of $21,000 is contributed to regional HACC by Local Government. The funding is allocated into the budget and provided to local areas to use for provision of services. She said council should liaise with Mr Stephen Brown, Team leader if they needed more indepth local information.

Cr McLellan said she was not totally satisfied with this response, while it was great as far as it went but she had hoped for a more detailed breakdown of specific aspects of funding.

She said "HACC do a great job, I am in no way disputing that, I just had hoped for a detailed financial statement'.

She said she would follow up her enquiries with Mr Brown.

MOUNT MONSTER MEETING

Cr Allen and the CEO met with John Schulz, Dennis Kuhlmann and Randall Johnson from Department of Environment and Heritage at Mount Monster in October.

Discussion related to 3 parcels of land.

- Conservation Park.
- Stone Reserve which is under council's care and control, this includes a deep quarry with steep sides and several patches of rate Monato Mintbush.
- Freehold section owned by council and includes an area that has been quarried for rail and road crushed rock.

Council have indicated that they are willing to sell – or even give the freehold land to the department so that it can be added to the Conservation Park. The department is interested in obtaining this land and will get back to council with an offer.

In addition, the department are interested in taking over the Stone Reserve and are arranging for Government Risk Assessors to see what is involved if council hands over control.

If the Stone Reserve was relinquished, Mr Harkness said it would reduce the chances of the quarry being used again which may not be an advantage for council.

Boral Resources are endeavouring to open up the mine again.

Mr Harkness said it may be worth adding some of the Stone Reserve to the park to protect the mintbush and adding some of the freehold land to the Stone Reserve.

Cr Allen asked what advantages were there for council if the mine reopened.

Mr Harkness said the crushed material obtained locally would be cheaper than sourcing it from Harrow, Adelaide or Mount Gambier.

Cr Vickery said he thought it would be foolhardy for council to cut off this possible source of material, it was much more sense to keep options open for the future.

EFFLUENT CONTROL SYSTEMS

Environmental Health Officer, Dr Bob Netherton presented a report to November council committees on this issue as there has been increased interest in the way waste water was being recycled with an emphasis on the direct use of "grey water" and council will come under increased pressure to change its policies.

Local Government has the control of liquid domestic waste under legislation since 1994.

The principles of liquid waste control has been virtually unchanged since the 19th century and has stood the test of time and has been responsible for a dramatic change in human health with elimination of cholera and typhoid among other diseases.

The four principals of effluent control are:

- collection;
- digestion;
- sanitation;
- disposal.

On site disposal, the digestion of solids takes place in a container usually referred to as a septic tank, this is a closed container where the bacteria work without oxygen.

The liquid which comes out is potentially quite dangerous and needs to be 'sanitised'.

In soils where drainage and soakage is satisfactory, the effluent is exposed to oxygen in an underground plastic tunnel. Both digestion and sanitisation are most important.

Where the soil is poorly drained, an extra step is necessary. This is an artificial aerobic treatment of effluent, by chlorine and the effluent can then be disposed of above the ground in a dedicated area. This is an efficient system, unchanged for 10 years and in Dr Netherton's opinion will continue for some time in the future.

The Environment Protection Authority policy is that no effluent shall enter the ground water table.

In the Tatiara with the exception of Padthaway, the septic tank disposal system STEDS operates. This is the same principle but with the oxygenation and disposal phases are separate.

New disposal methods are becoming available with a new aerobic only treatment system just approved, but Dr Netherton warned that it was necessary to maintain the standards already established and not to "race into new ideas that may or may not work."

Dr Netherton said he was pleased that the 'grey water separator' was not on sale in this region as the device was not legal.

Tatiara
the good country

TATIARA DISTRICT COUNCIL

COUNCIL INFORMATION

43 Woolshed Street, Bordertown – Phone 8752 1044, office hours 8.30 a.m. to 5 p.m.
34 Hender Street, Keith – Phone 8755 3347, office hours 9 a.m. to 4.30 p.m.

MEETINGS: Members of the public are welcome to attend the following meetings:

- Clayton Farm Heritage Museum Committee — Thursday, December 2, at 8 p.m. at Clayton Farm.
- Council Committee Meeting — Tuesday, December 7, at 9.30 a.m. in the Council Chamber, Bordertown.
- Council Meeting — Tuesday, December 14, at 10 a.m. in the Council Chamber, Bordertown.

WORKS CARRIED OUT during week ending Friday, November 26, 2004:

- Hills Road and Richards Lane maintenance.
- Teatrick Pooginagoric Grade up Dirt Track.
- Keith Streets and Emu Flat Road – Patching Sealed Roads.
- Slashing Rural Roads — Teatrick, Wolseley and Bangham Roads.
- Cannawigara Road tree trimming.
- Wolseley Township signage maintenance.
- Bennett Street maintenance.
- Racecourse Lane maintenance (drainage).
- Rural Road Patching Sealed Roads.
- Roadside Mowing Keith Township – Dukes Highway, Dark Island Well Road and Hd of Makin Road.
- General Park maintenance – Keith – Protuberances.
- Water feature maintenance/repairs.
- Verge maintenance adjacent Dukes Highway/Service Road at northern end, BP at Heads and Lions Park.

SOUTH AUSTRALIA'S YOUNG ACHIEVER AWARDS:

The search is on for talented young South Australians to enter the 2005 Young Achiever Awards. Nominations are invited for:

- **The Coffee Club Arts Award**
- **Intencity Sports Award**
- **Allianz Community Service Award**
- **Boileau Business Solutions Career Achievement Award**
- **AGL Regional Initiative Award**
- **Faculty of Sciences at The University of Adelaide Science & Technology Award**
- **SA Water Environment Award**
- **Office for Youth Outstanding Young Indigenous Achiever Award**

The aim and objectives of the Awards are to encourage, reward and most importantly promote the positive achievements of young South Australians in the 14 to 26 age group. Nomination forms are available from either the Bordertown or Keith Council Offices, all sponsors, through the website www.awardsaustralia.com by contacting the Awards Office on (08) 8132 0753. **Nominations close on Friday, January 14, 2005.**

AUSTRALIA DAY CELEBRATIONS

This years Australia Day Awards and Celebration Ceremony will be held at the Wolseley RSL Community and Recreation Centre on Wednesday, January 26, 2005. Breakfast will start from 7.30 a.m. with the presentations to begin at 8.45 a.m.

VISITOR INFORMATION CENTRE (V.I.C.)

Local artist **Melanie Manser** is this month's feature artist at the Tolmer Art Space. Melanie's work will be on show at the VIC Centre, North Terrace, Bordertown from December 3-29. Phone 8752 0700 or Fax 8752 0644.

ROBERT HARKNESS, Chief Executive Officer

BORDER CHRONICLE
OCTOBER 2005

Letters to the Editor

Opposed to mining parkland

Sir,

I would like to bring to the attention of the community, that Tatiara District Council has resolved to make additions to Mount Monster Conservation Park and the adjacent stone reserve.

The best areas of vegetation in the stone reserve and Lot 11 (between the main quarry and the Park boundary), will be added to the Conservation Park, while almost half of lot 11, is to be added to the stone reserve.

I am pleased that these areas will be added to the park, however it is unfortunate that due to joint proclamation, mining will not be excluded from these areas.

The additions to the stone reserve concern me for the following reasons.

First, it indicates to me that council wishes to facilitate re-opening of the quarry.

Also, in 1984 council resolved that lot 11 be held as parklands within the meaning of the Local Government Act 1934-1983, where "park land" is defined as "land declared or set apart as a park or set aside for the use and enjoyment of the public". Hence this area is going from parklands for community use and enjoyment, to stone reserve for mining.

Finally, the area to be added to the stone reserve, although disturbed, still has significant conservation values in itself. It also acts as a buffer to the conservation park, and adds to the total area of habitat for our local native plants and animals.

For these reasons I would prefer that all of Lot 11 is allocated to conservation park or that it is returned to community land to be retained for the community as parkland, rather than becoming stone reserve.

I encourage others who have such concerns or queries, to contact our local council.

Jenny McInerney

Mining issues resurface

Mount Monster's picnic area and well maintained walking trail have long been popular with Keith people, and its silhouette has become a familiar landmark for travellers.

Now the area's granite rock is sought after as accessible, high quality base aggregate for road building. It is believed two companies have expressed interest in developing the old quarry site further.

Tatiara District Council has negotiated to retain some scrub adjacent to Mt Monster Conservation Park, but quarrying is proposed immediately adjacent to the conservation parks' northern boundary.

The proposed new quarry site is only 500 metres north of the summit's highest point.

The proximity is a concern to Keith field naturalist, David Sando who says, "because there have been moves to recommence mining in the area it should be done in a way that doesn't damage the Mt Monster environment. A natural population of Monarto mint bushes, the only one flourishing in the entire state, is currently growing within five metres of the lip of the proposed new quarry. The conservation park is home to a phenomenal variety of orchids, as many as 32 different kinds have been identified, as well as a very rare coral lichen, again only found at Mt Monster. It's a shame the new quarry is so close to so many vulnerable orchids."

Without some kind of protection, rare birds such as the southern scrub-robin are under threat also. Wholesale development could impact dramatically on the region's farm forestry. Seen as one of the most biologically diverse areas in the Tatiara, Mt Monster Conservation Park is home to millions of minute sundew plants which operate as insect controls, allowing young saplings to flourish beyond the confines of the park.

Aware of the need to balance the needs of environment and development, David Sando maintains, "quarrying is possible if a suitable buffer is maintained.

"Much of the old quarry near Mt Monster Road could be mined without significant damage. Mining however, would not be appropriate in the section of hill slope which adjoins the boundary of the park, home to so many rare plants and animals. A buffer could minimise dust and pollution damage, but the most difficult problem with increased activity could be weed control. Noxious weed spread threatens the very future of Mt Monster as a valuable conservation park.

"Safeguards that include appropriate monitoring, could allow development to proceed however."

Environmentalist, David Sando, by the boundary post.

PARCEL 11

CURRENTLY OWNED BY TATIARA DISTRICT COUNCIL

Border Chronicle

Your local newspaper serving Tatiara district (Bordertown, Keith, Mundulla, Wolseley and Padthaway), Tintinara, Coonalpyn and the Victorian border districts.

Phone (08) 8752 1511, Fax (08) 8752 1293, Email: manager@borderchronicle.com.au

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Mount Monster limbo

TDC and community await mining claim

Environmentalist Jenny McInerney who is opposed to mining in Mount Monster wants to preserve the rare Monarto mintbush.

THE future status of land adjoining Mount Monster Conservation Park, and whether it will be mined, are still to be decided.

But Tatiara District Council has had a first-hand look at the area with Mrs Jenny McInerney, who opposes mining there.

Councillors toured the area – which local people want to keep intact for recreation and to protect plants, animals and birds – after its monthly meeting in Keith on November 15.

They will discuss the issue again at their December meeting.

Two companies are interested in quarrying granite for high quality base aggregate for road building – although chief executive officer Mr Rob Harkness said the material was "very abrasive and very expensive".

The CEO told the Keith meeting that the council had agreed to sell Lot 11, or part of it, to the Department for Environment and Heritage to add to the conservation park.

SeaGas had obtained approval to provide $25,000 to the department, which would then give that money to the council to compensate for the loss of the land.

But for this to happen, the land could not still be classed as "community land" – which is its present status.

The public would have to be consulted before the council could revoke the "community land" status.

Mr Harkness said there were a number of hazards in the area "so it's a bit of a liability" and suggested that it could be fenced.

Cr Richard Vickery said: "People would breach the fence no matter what."

Mrs McInerney, whose family has lived in the area for four generations, showed the councillors and staff around Lot 11 and the stone reserve.

In the stone reserve, she showed them the Monarto mintbush, which is found only at Mount Monster and Monarto, near Murray Bridge.

Mrs McInerney said a number of other endangered species also grew locally. There were at least eight native orchid species and more than 47 native plants growing within 10m of the current quarry walls.

She said the community used Lot 11 for recreation and it also acted as a buffer to prevent weed invasion.

"If mining were to occur in Lot 11, as suggested by the current proposal, mining could go right up to the park boundary, removing the buffer.

"Lot 11 increases the habitat near the park so viable populations of native plants and animals can be conserved.

"In an area which has been cleared for agriculture, this is very important for conservation.

"It is even more important now than it was when mining first took place as so much more vegetation has been cleared since the 1950s."

Mrs McInerney said if vegetation and habitat were reduced, there may not be enough resources to support the populations of flora and fauna there now.

The old quarry in lot 11 had 30 years of natural regeneration and semi-permanent waterholes which had been colonised by water plants, birds and frogs.

Before the tour of Mount Monster, the council's Keith meeting adopted a three-part resolution to tell Mrs McInerney that:

- The council has received no information about the level of mining which "may" take place at Mount Monster.
- When or if the department gets an application for a mining lease, it will tell the council and also advertise to invite public comment.
- Primary Industries and Resources SA is the Government department to advise on the mining lease process.

This resolution, from the November 1 meeting of the administration and finance committee, was in response to Mrs McInerney's concern that the community was not being made aware of the type and scale of mining which may occur.

She asked whether the council knew what level of mining was planned for the stone reserve.

She also asked the council to confirm or refute that 280,000 tonnes of rock and 70,000 tonnes of overburden could be removed.

Mr Harkness told the committee that two companies, Boral Resources and Mega Minerals (Steve Mathews) had pegged a mineral claim over the stone reserve "on several occasions.

"They have been in dispute over who has the valid claim.

"When one of the companies has a valid claim, I assume that they will prepapre an application for a mining lease.

"A lease gives the exclusive right to mine and sell the minerals specified in conditions attached to the lease."

Mr Harkness said the department would give notice of all lease applications in the Gazette and a Statewide newspaper; and send a copy to the landowner and the council. Time would be allowed for written comments.

An application for a lease would have to include a vast amount of information about how the mine would operate.

This would include the effect on the environment, native vegetation, water and rehabilitation.

"I understand that the department has to be happy with the proposal before it gets to the public consultation stage," the CEO said.

"At this stage council has received no information as to the possible extent of mining at Mount Monster, hence we cannot confirm or refute anything."

Mr Harkness said Boral Resources and Mega Minerals had been "fighting it out in court as to who has the legal right to peg it. That process is continuing on and, until they resolve that and put in an actual application, we don't know what they're planning to do."

Cr Vickery told the committee that "we're simply in a waiting game" and could only tell Mrs McInerney that it didn't have information about the mining proposed at Mount Monster.

• **"Mount Monster land sale complicated" – 7.**

State MP Vini Ciccarello with Mundulla Primary School students Courtney Young (left), Claudia Melino and Brody Lock.

Mundulla tells it like it was

THREE Mundulla Primary School students have finished second in a State competition.

The Year 4 students came out on top of 85 other schools to take out the Highly Commended Entry Award for their story about local heritage.

The competition's theme was "Our heritage – their stories: telling tales of heritage places", which encouraged students to discover stories in their community, and share them with others.

Mundulla Primary School created a powerpoint presentation titled: "Despite time and changes this building continues to be used for a specific purpose and is an important part of the community".

It was about the school building, and how it has been an important part of the community.

Teacher Joann Packer said Mundulla, Bordertown and Padthaway Year 4 classes had all researched the district, and the Mundulla students interviewed various members of the community – including Bordertown residents – to gather information about the school.

Mrs Packer said the children learnt that the "building stays the same, but the function is different".

"Special things happen at school as well as the learning," she said.

Courtney Young, Claudia Melino and Brody Lock then went on to do further research, which included interviewing a parent who had got married at the school.

Mrs Packer said the students worked independently on their entry, with very little help.

The three students travelled to Adelaide with their parents and Mrs Packer to accept the award from State MP Vini Ciccarello at Urrbrae House.

Mount Monster land sale complicated

THE proposed disposal of some land near Mount Monster Conservation Park is not simple and straightforward.

Tatiara District Council has agreed to sell Lot 11, or part of it, to the Department for Environment and Heritage to add to the park.

But this will require public consultation and Ministerial aproval and may take at least three months.

The land is still classed as "parklands", so the council would have to revoke the classification of the land.

The department has offered $25,000 to buy Lot 11 (DP 13037 in the Hundred of Stirling).

It would also resume ownership of part of a stone reserve (Section 499).

In October the council decide to get legal advice on the status of Section 11.

It also decided to prepare a report on selling the whole of Section 11 to the DEH; or keeping the mine portion of this Section in its "care and control".

Mrs Jenny McInerney and other local residents are concerned that one of two mining companies interested in reviving the mine and quarrying for granite will disturb the native plants, animals and birds.

Chief executive officer Mr Rob Harkness told the November meeting of the administration and finance committee that the proposed alterations to property boundaries at Mount Monster included:

- Part of Lot 11, freehold title owned by the council, being added to the park.
- Part of Lot 11, freehold title owned by the council, being added to the stone reserve.
- Part of the stone reserve being added to the park.
- The council being granted $25,000 compensation.

Adelaide solicitor Norman Waterhouse provided a five-page letter of advice on the status of Lot 11.

Mr Harkness said Norman Waterhouse identified "a few problems, which can be tidied up, but which will delay the entire process".

Senior associate Ms Susie Slade told the council:

- Lot 11, although freehold land owned by the council, is also "parklands" under the Local Government Act.
- The council excluded this land from being community land but should have revoked its classification.
- To sell the land, the council would have to revoke the community land classification.
- This would require public consultation and approval from the Minister, which could take at least three months.

Mr Harkness said the advice was provided on a wrong premise that the council had excluded its community land after December 31, 2002.

In fact, the council resolved it in October 2002 and gazetted the motion in November 2002.

As Lot 11 was parkland, it may have to go through a different process.

"How much of Lot 11 council transfers to the conservation park is up to council," he said.

"At present we were planning to join the land containing the smaller, shallower quarry to the stone reserve.

"In my opinion, it has been left in an untidy shape and would benefit from being tidied up.

"This is more likely to happen if the larger quarry was reopened. If the quarry was to be reopened some time in the future, I don't believe this area would be greatly affected."

Mr Harkness has asked Mr Dennis Kuhlmann if the DEH is interested in taking over the whole of Section 11.

In the meantime the council adopted his recommendation to inspect the stone reserve and Lot 11 after its meeting at Keith on November 15.

Cr Janet Allen said: "It's very important that we're aware of what's happening at Mount Monster.

"I commend Jenny McInerney on her persistence in pursuing the status of the land and the freehold because it's community land.

"It's very important as a buffer zone to Mount Monster. Council has to be very careful in their decision-making: it could have large ramifications."

The issue is expected to be discussed at the administration and finance committee meeting on December 5 and the council meeting on December 12.

Border chronicle
November 24th
2005

State wants to buy all of Mount Monster

THE Department of Environment and Heritage wants to buy the Mount Monster land, but can't promise that there won't be any mining.

Jeff Wauchope and Dennis Kuhlmann from the DEH spoke at the Tatiara District Council's January committee meeting.

"This issue has been raised off and on since 1993," Mr Wauchope said.

"We have had a couple of letters from council in the last six months.

"There was an agreement that we could purchase section 11. More recently council asked our view about the whole parcel of land."

He said that it would be preferred if DEH could add all of section 11 to the conservation park, which would mean more practical boundaries.

"There are also some legal issues that could be resolved with all of section 11."

MANAGEMENT. Mr Wauchope recognised that the conservation park is a place that receives "reasonable visitation from tourists and it attracts visitation from locals".

He said that there would be a draft plan of DEH's proposed management of Mount Monster that would undergo three months of public consultation.

The management would be similar to how the council manages it.

"Council has erected signs and barriers and we would continue that," Mr Wauchope said.

MINING. Mr Wauchope described the mining situation at Mount Monster as "complicated" as section 11 is a private mine.

DEH would try and declare that section as single proclamation, which would exclude it from mining, but that would "depend on discussions with the private mine owner and Primary Industries (and Resources)".

"Traditionally we have found it difficult to do proclamation, but we think it's a fairly good argument to do that under single proclamation.

Dennis Kuhlmann (left) and Jeff Wauchope from DEH spoke to Tatiara District Council about Mount Monster.

"We think with the stone reserve the department has had no objections to quarrying in the area.

"We recognise it's the only source of road material in the SE ... it would be nearly impossible to do it under single proclamation."

Mr Wauchope said that joint proclamation could be possible, which would mean that mining could occur but the DEH minister would have the power to inflict regulations and restrictions on what happens.

Mr Kuhlmann added that the restrictions can make it tough on miners so they may walk away from it because the regulations are just too hard.

Cr Richard Vickery said that it would be important that the recreational activities enjoyed by families in the past should continue, and asked how DEH's staff would manage the park.

Mr Wauchope said: "In relation to resources, we will not be getting additional resources, we will use existing ones.

"Our concern is safety ... it's a dangerous area.

"All of our parks are set up under legislation for conservation and enjoyment."

Mr Kuhlmann also emphasised the safety and practicality of rehabilitating cliff faces as asked by Cr Janet Allen.

"There are lots of rubble heaps lying about the place and there is some scope to clean it up," he said.

"It would be a major job to rehabilitate the cliff faces. It would be better to leave them as they are."

Mr Wauchope concluded that DEH would like to "purchase all of it to add to the park".

"It may be easier to add it all to the park ... It would not stop mining, but it would allow the Minister to impose restrictions," he said.

Borderchronicle
January 19th 2006

Council call to add land to Mount Monster

TATIARA District Council is finalising Mount Monster's future, advising the government that it wants land to be added to the conservation park and that it's not opposed to mining.

The council received approval from the Local Government Minister to revoke the community land classification of section 11 at its September meeting.

Cr Ed Davis moved and Cr Janet Allen seconded that the council now revokes the classification.

The council will begin negotiating with Department of Environment and Heritage to have section 11 added to the Mount Monster Conservation Park "on the understanding that the department will reimburse the council $25,000 using funds given to them by Seagas in exchange for environmental credits".

Cr Diana Penniment moved and Cr Allen seconded that the council would advise the Department of Environment and Conservation that it supports the department taking control of the stone reserve, so it can be added to the Mount Monster Conservation Park.

Cr Penniment moved and Cr Allen seconded a third recommendation to advise the department that the council, "Recognises that this site (stone reserve) is an important source of material for future construction purposes and hence is not opposed to future mining taking place as long as it was carried out in a sensitive manner."

REFERENCES

Burtt, A.C. and Abbot, P.J., 1998. The Taratap Granodiorite, South-East South Australia. *MESA Journal,* 10:35-39.

Henstridge, D.A., 1970. The Petrology and Geochemistry of the Upper SE Granites SA. *B.Sc. (Hons.) thesis, University of Adelaide* (unpublished).

Janz, J.K. (Hough), 1990. The Mineralogy and Paragenesis of the Poona Mine Copper Deposit. *B.Sc. (Hons.) thesis, Flinders University* (unpublished).

Johns, R.K., 1951. Granite Deposit – Mount Monster. *SA Department of Mines. Report Book 31/76* (unpublished).

Mason, D., 1997. Mason Geoscience 1997, Report 2294. Petrographic Descriptions for Granitoid and Metavolcanic Rocks from the Southeast of South Australia.

Mawson, D. and Dallwitz, W.B. 1944. Palaeozoic igneous rocks of Lower South-Eastern South Australia. *Trans. R. Soc. S. Aust.,* 68(2), 191-209.

Mawson, D. and Segnit, E.R. 1945. Porphyritic potash-soda microgranites of Mount Monster. *Trans. R. Soc. S. Aust.,* 69(2), 217-222.

Pain, A.M. and Robertson, R.S., 1981. Mount Monster porphyry deposit near Keith, Murray Mallee. *Geological investigations 1978–81. South Australian Department of Mines and Energy. Report Book 81/112.*

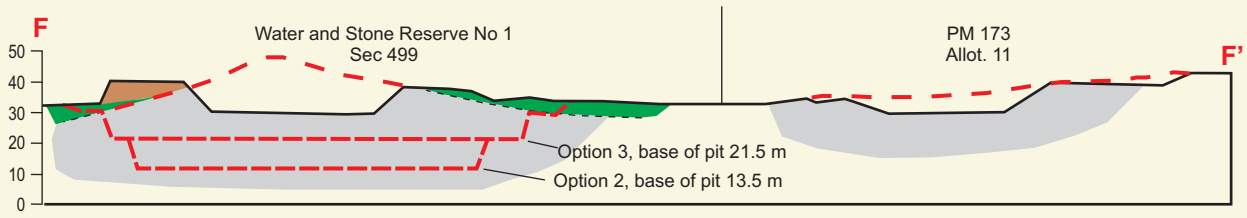
Pain, A.M., Robertson, R.S. and Rosier, C.M., 1984. Mount Monster and Papineau Rocks aggregate deposits. *Mineral Resources Review, South Australia,* 154:46-53.

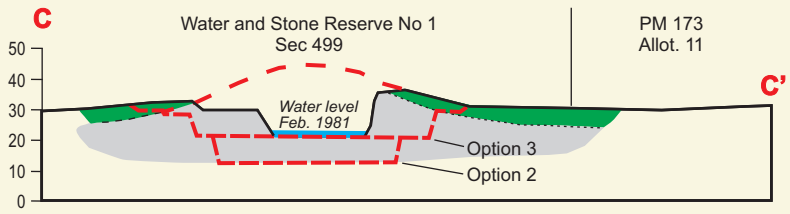
Rochow, K.A., 1969. NARACOORTE map sheet. *South Australia. Geological Survey. Geological Atlas 1:250 000 Series,* sheet SJ 54-2.

Rogers, P.A., 1995. Geology of the South-East, South Australia. Second Edition. *South Australia. Geological Survey. Special Map,* 1:500 000.

Rosier, C.M. and Pain, A.M., 1982. Papineau Rocks rhyodacite aggregate quarry. *Geological investigations. South Australian Department of Mines and Energy. Report Book 82/99.*

Toteff, S., 1979. Mount Monster In: Toteff, S. and McBriar, E.M., Geological Monuments in South Australia, Part 2:80-82. *Geological Society of Australia* (unpublished).





OVERBURDEN

- Made ground – spalls, concrete, etc.
- Silt, clay and weathered rhyolite

ROCK SUITABLE FOR AGGREGATE

- Porphyritic rhyolite

- Original natural surface
- Proposed final quarry outline

NOTE: For all sections A-A' to H-H' see RB 81/112

MT MONSTER DIFFERENTIAL GPS DATA - M. FLINTOFT 31/10/06 -1/11/06

SITE ID	SITE NAME	EASTING	NORTHING	ELEVATION	COMMENT
1	6925/4023	438,194.00	5994706.00	26.63	BM 6925/4023
2	SWCP	438,604.80	5993874.36	26.83	South West corner peg
3	NWCP	438,603.11	5994370.21	26.77	North West corner peg
4	NECP	439,086.67	5994127.16	29.16	North East corner peg
5	SECP	439,088.00	5993877.09	32.41	South East corner peg
6	SWCFA	438,924.76	5994014.33	36.03	South West corner of fenced area
7	NWCFA	438,906.64	5994034.91	39.16	North West corner post fenced area
8	NCPFA	438,907.65	5994047.45	35.87	North corner post fenced area
9	NECPFA	438,922.20	5994061.65	34.18	North East corner post fenced area
10	EBPFA	438,941.23	5994055.61	34.30	Eastern boundary post fenced area
11	SECPFA	438,946.63	5994038.27	35.33	South East corner post fenced area
12	TOFNQ	438,915.47	5994002.48	34.99	Top of face North quarry
13	NWENDNQ	438,727.47	5993973.44	29.92	North west end North quarry
14	TOFNWCSQ	438,858.73	5993767.36	36.73	Top of face north west corner South quarry
15	TOF WCCQ	438,860.33	5993736.30	38.37	Top of face west corner South quarry
16	TOFSECSQ	438,965.21	5993773.70	39.65	Top of face south east corner South quarry

438600 438800 439000

5994400 5994200 5994000 5993800

MOUNT MONSTER ROAD

ROAD RESERVE

Water and Stone Reserve No 1 Sec 499 MC 3631

PM 173

PM 173 Allot. 11

Former stockpile area

Former plant area

Northern Quarry

Southern Quarry

Fenced area - Monarto Mintbush

MT MONSTER CONSERVATION PARK

MT MONSTER CONS. PK

28 30 40

26•77 26•83 29•92 29•16 32•41 35•87 34•18 39•16 36•01 34•30 35•33 34•99 36•73 39•65 38•37

C C' F F'

Legend

- Current quarry
- Proposed final quarry outline revised from RB81/112 (Pain and Robertson, 1981)
- C C' Section
- Contour (2m interval)
- Cadastral and mineral tenement boundaries
- Mineral Claim
- Private mine
- Track
- 26•83 DGPS point and elevation (m AHD)

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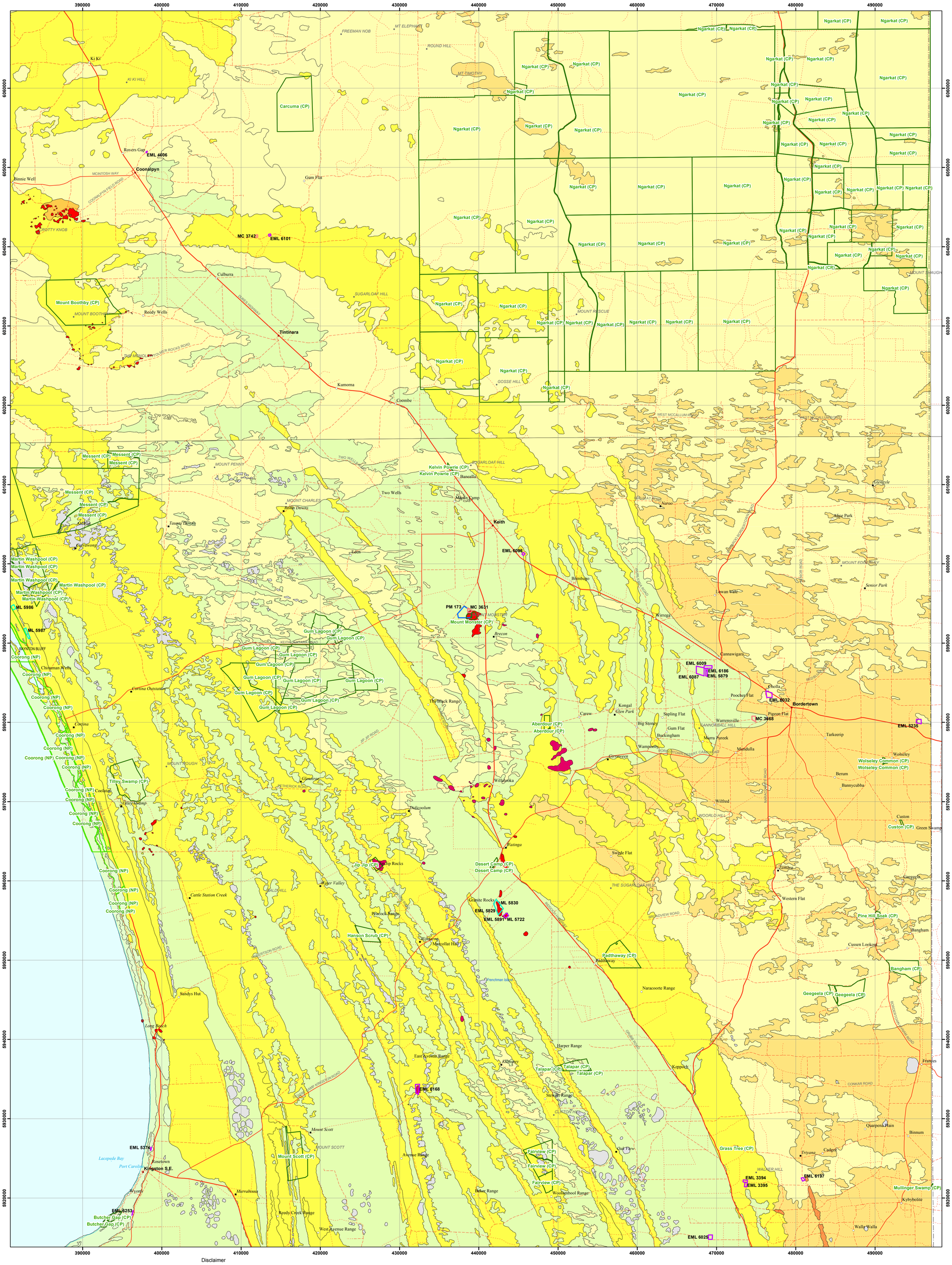
0 50 100 150 200 Metres

Datum GDA94 – Map Projection MGA Zone 54

MT MONSTER RHYOLITE QUARRY PLAN AND SECTIONS

Figure 7

UPPER SOUTHEAST GEOLOGY & MINERAL TENEMENTS



Legend

Current Mining Production Tenements

- Extractive Mineral Lease
- Mineral Claim
- Mineral Lease
- Miscellaneous Purpose Licence
- Miscellaneous Purpose Licence Application
- Private Mine

Parks

- Conservation Park
- National Park
- Recreation Park

Geological Units and Descriptions

Quaternary

Holocene

- Qr - Thin sand, clayey sand and carbonate overlying Tpp
- Qhl - Undifferentiated Holocene lacustrine/playa sediments
- Qhcks - St Kilda Formation. Unconsolidated white bioclastic quartz-carbonate sand of modern beaches and transgressive dune fields.
- Qhck4 - St Kilda Formation. Supratidal clay/gypsiferous dunes/lunettes.
- Qhck2 - St Kilda Formation. Carbonate, algal sediments of Coorong, ephemeral lakes.
- Qhck1 - St Kilda Formation. Lagoonal, lacustrine sediments of Coorong, ephemeral lakes.
- Qhckh - St Kilda Formation. Gypsiferous lacustrine sediment of coastal saline lakes.

Pleistocene-Holocene

- Qem - Molineaux Sand. Sand, pale yellow, fine to medium-grained quartzose.

Pleistocene

- Qp\\ca - Undifferentiated Pleistocene calcrete
- Qpcp - Padthaway Formation. Mudstone, calcitic and dolomitic, white; clay, greenish; quartz sand, clayey. Lacustrine. Fresh-water fossils.
- Qpcg - Glanville Formation. Clay, mottled, shelly; calcarenite, skeletal, coquina. Geochron age 132 000+/-6 000 years Bp on TL
- Qpcb - Bridgewater Formation. Bioclastic barrier shoreline deposits, silica rich, with heavy minerals, shallow sub-tidal. Coastal, cross-bedded aeolian calcarenite with palaeosol horizons and capped by calcrete.
- Qpcb8 - Bridgewater Formation. Young subunit with prominent beach ridges still present.
- Qpcb3 - Bridgewater Formation. Upper Member.
- Qpcb2 - Bridgewater Formation. Lower Member.
- Qpc1 - Pleistocene lagoonal algal dolomite north of Coonalpyn.
- Qpeo - Sand, pale reddish-brown silty and clayey quartz, pedogenic carbonate. Aeolian

Tertiary

Pliocene

- Tpp - Parilla Sand. Sand, fine to medium-grained, unfossiliferous, non-marine, clayey, quartz rich; sandy clay. Aeolian, lacustrine and fluvial deposits.
- Tpl - Loxton Sand. Sand, glauconitic, micaceous and shelly gravel; Coarse-grained sand and fine gravel, and calcareous micaceous, medium to coarse-grained sandstone. Shallow marine through beach environment of deposition.

Oligocene-Miocene

- Tym - Mannum Limestone. Calcareous sandstone, sandy limestone, bryozoal limestone
- Thg - Gambier Limestone. Limestone, fossiliferouse. Open marine shelf.

Cambrian-Ordovician (Syn-Post Delamerian Orogeny) Intrusive & Volcanic Rocks

- EOdo - Rhyolite, porphyritic, quartz and tabular feldspar phenocrysts; orange-brown or grey-green groundmass with feldspar phenocrysts; Flow banded, may be welded ash flow in part. A-type, post-tectonic. Age 464+/-7Ma (U-Pb). (Mt Monster & single small outcrop 7 km south).
- EOd1 - Acid volcanic rocks - undifferentiated. (eg Papineau Rocks).
- EOdc - Granite, green to olive-green, coarse-grained; green feldspars, smoky quartz and amphibole. A-type, post-tectonic. ('Padthaway green granite')
- EOdt - Taratap Granodiorite, blue-grey, porphyritic (plagioclase), qtz-plag-microcline-bio-hbl. Comagmatic and metasedimentary enclaves. Biotite and microcline flow lineation. S-type, post-tectonic, 475+/-65 Ma (IR=0.7160)
- EOd4 - Undifferentiated Delamerian acid intrusives
- EOd11 - Adamellite, medium-coarse, pink hornblende-biotite. Based on Odg1a, PINNAROO
- EOd12 - Granite, medium-coarse, pink, hornblende-biotite. Based on Odg1b, PINNAROO
- EOd13 - Leucogranite, fine-coarse, red-pink, fluorite-bearing. Based on Odg2, PINNAROO

Scale 1: 200 000

0 4.5 9 18 Kilometres

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