DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY
MINERAL RESOURCES DIVISION

CONSTRUCTION MATERIALS RESOURCES ADELAIDE AREA

FIRST SUMMARY REPORT

by

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Rept.Bk.No.72/165
G.S. No. 4930
DM. No. 1275/70

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DEPARTMENT OF MINES
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ABSTRACT

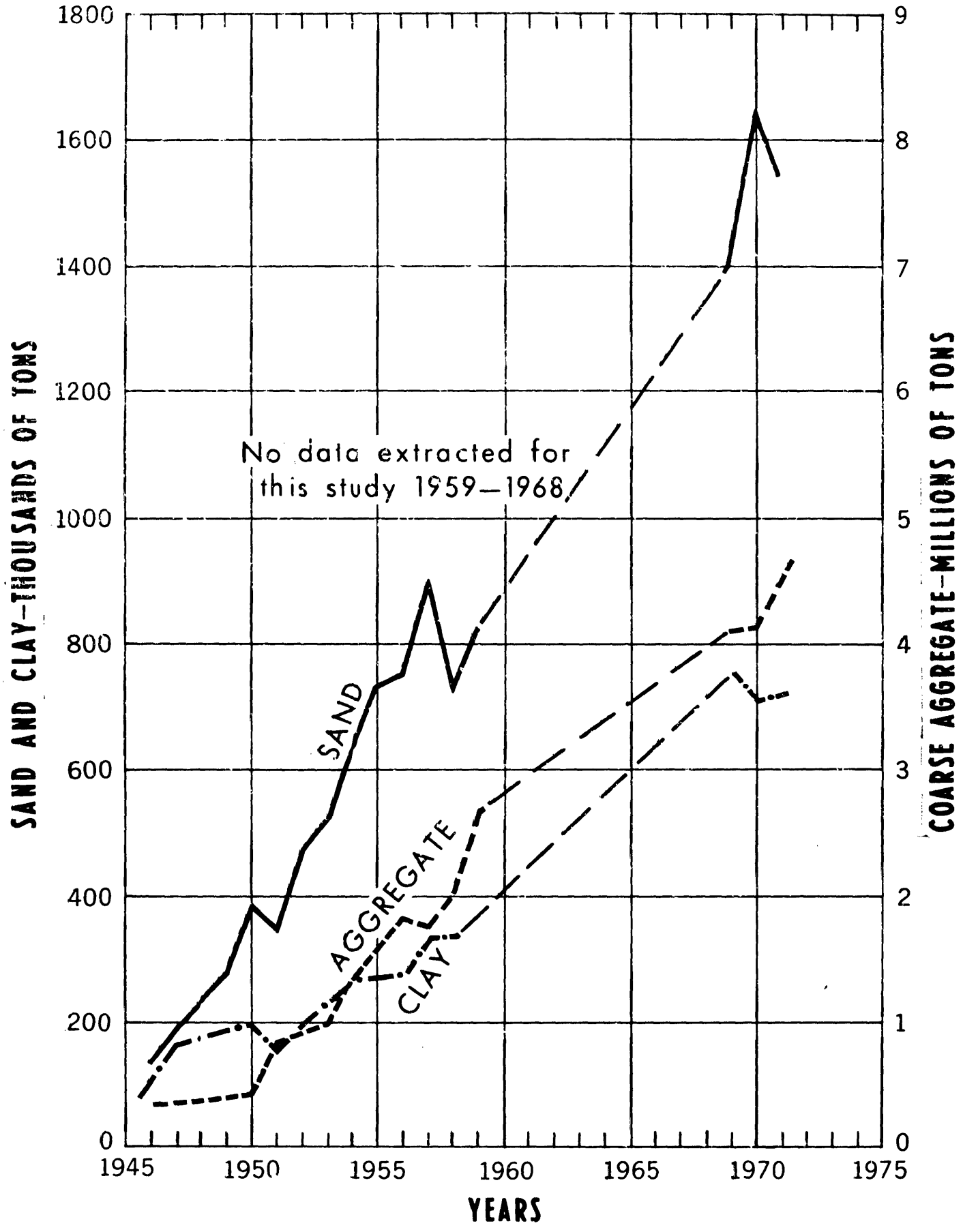
Almost 7 million tons of clay, sand and coarse aggregate were produced in the Adelaide area in 1971.

Sources of construction materials are described in the context of their regional geological setting. Because the materials occur in sedimentary sequences, whose limits are mappable, it is possible to recognise those resources which are in limited supply. White plastic clay, filling and construction sands occur in Tertiary and younger formations which are of restricted extent. White shale and carbonate rocks for coarse aggregate are also limited in close proximity to Adelaide, although large resources exist further away. Beds containing potentially useful deposits of quartzite aggregate, red plastic clay, brown shale, monumental stone and rock fill are extensively developed.

Legislation relevant to the acquisition and working of extractive minerals is summarised.

INTRODUCTION

Resources of clay, sand, coarse aggregate and building stone are essential for every city and town. They are being consumed in ever increasing quantities, both on account of population growth and higher standards of services and structures provided for the community. Figure 1 overleaf illustrates the growth in consumption of clay, construction sand and coarse aggregate in the Adelaide area through the years 1946-1971.



Years 1946 to 1959 — Mining Review 113

Years 1969 to 1971 — Production returns

72-190 MRR 137 S.A. Dept. of Mines

Construction materials are non renewable resources, being bound up in the structures and services which support our way of life. Thus new deposits will be required to provide for the future needs of the community. Because transport charges account for a significant proportion of the total cost, it is desirable, in terms of economic benefit to both the public and private sectors of the community, to have the sources of these materials as close as possible to the places of consumption.

Most of the deposits supplying metropolitan Adelaide are located on the fringe of the developed areas and in some cases, e.g. the sand and clay deposits of Golden Grove and Tea Tree Gully, have been engulfed in the recently expanded suburban areas. Zoning regulations and legislation controlling the Hills Face Zone have reduced the capacity of some of the working deposits to expand. Increasing public concern for the environment is generating pressure on the Government and quarry operators in respect to the nuisance caused by dust, noise and physical damage to the landscape.

Thus there is a need to recognise and set aside new sources of materials to provide for the future of the industry and its consumers and to satisfy the requirements of environmental harmony.

It is often said that residential areas should be protected from the effects of quarrying but it is equally true that quarry sites should be protected from housing development.

Planning of land use around every major city should have regard for the provision of adequate resources of construction materials for future generations. This has two aspects.

In the short term it is necessary to provide sufficient land around existing working deposits to permit; the extraction of those reserves which can be won without undue permanent damage to the landscape; the operator to work the deposit for sufficient time to return his capital outlay; the provision of adequate buffer zones around the operation.

In the long term it is essential to ensure that the land containing those deposits, which through quality, quantity and geographic location are necessary for the future needs of the community, is available for quarrying when required.

The location and distribution of construction materials resources is determined by geological events of the past. Thus we have no control over the location in which useful deposits occur but in many cases we have a choice of which deposits should be worked when a particular resource occurs in large quantities at several localities.

This report has been prepared to show the distribution of the productive and potentially productive geological formations containing construction materials. It is a preliminary compilation based on published 1:63 360 scale geological mapping of the Geological Survey and supported mainly by data on file in the Department of Mines.

Its purpose is two fold:

1) to provide a basis for selecting specific projects for more detailed investigation by the Geological Survey.
2) to provide a summary of resources for the industry and those concerned with planning of land use.

A preliminary tabulation of working deposits is attached in Appendix 1 and the deposits are located on the accompanying plans. Both the tables and potentially productive formations on the plans are subject to field checking.

LEGISLATION

In South Australia acquisition of title to mineral deposits is defined and controlled by the Mining Act 1971 and Regulations. The Mines and Works Inspection Act (1920-1970) and Regulations are concerned with the safe and proper working of mines and quarries. Recent amendments to this legis-

lation have given the Inspectors of Mines wide powers, in matters relating to mining, concerning the environment. Both of these Acts are administered through the Department of Mines.

Policy on land use is defined and controlled under the Planning and Development Act 1966-1971 and Regulations jointly by the State Planning Authority and local councils. Control of subdivisions is carried out by the Director of Planning and local Councils. Land use in the Adelaide Metropolitan Area and the City of Mt. Gambier is subject to detailed planning regulations but in other parts of the State control is not yet established by other than general guide lines.

The National Parks and Wildlife Act 1972 and Regulations, the Waterworks Act 1932-1971 and Regulations and the Coast Protection Act 1972 also contain legislation affecting the acquisition of land for mining purposes.

The following resumé has been included to outline the general principles of the legislation as it affects a person intending to acquire and work construction materials deposits. The reader is referred to the relevant Acts and Regulations for full details and information on specific points.

Mining Act, 1971 and Regulations

Under the Mining Act 1971, proclaimed on 3rd July, 1972, the ownership of all minerals is vested in the Crown and all 'private land' in respect to minerals under the repealed Mining Act 1930-1962 became 'mineral land'.

By way of compensation to the former owners of minerals, provision is made for royalties to be paid to them. Where the owner of minerals (under the 1930-1962 Act) is currently mining them or if he commences to do so within three years of the proclamation of the new Act, he may have the workings declared a 'private mine' and not be subject to the Mining Act 1971 except

in respect of royalty payments to the Extractive Areas Rehabilitation Fund (see below). It is envisaged that most of the metropolitan area quarries will become 'private mines'.

Certain land is exempt from mining, comprising essentially the area surrounding permanent buildings and water supply installations, land permanently used for agriculture or horticulture and land set aside, by proclamation, as reserves, parks, recreational grounds etc. With the exception of reserves, all exempt land may be available for mining on payment of agreed compensation or if no agreement is reached, by application to the Land and Valuation Court.

The holder of a miner's right is authorised under the Act to prospect for minerals (except precious stones) on all mineral land except exempt land.

A mining operator must give 21 days notice, in a prescribed form, to the owner of freehold and perpetual lease hold land; of his intention to enter upon the land, and; the operations that he proposes to carry out. Provision is made for the owner to object to either of the above.

A miner's right authorises an operator to peg a mineral claim on land not exempt from mining. Application for registration of the claim must be made to the Department of Mines within 30 days of pegging. Possession of a mineral claim confers an exclusive right to carry out mining operations* and to apply for a mining lease over the area of the claim but does not authorise the removal of more than 1 tonne of material unless the owner of the land or the warden's court grants consent nor does it confer any right to sell, dispose of or use any minerals for any commercial or industrial purpose.

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* Mining operations are defined in the Act as "all operations carried on in the course of prospecting or mining for minerals or quarrying and includes operations by means of which minerals are recovered from the sea or a natural water supply".

The area of an Extractive Minerals *claim is 20 hectares and regulations define the shape, methods for pegging, labour conditions etc. The right to peg claims and leases for extractive minerals on freehold land is restricted to the owner of the land or in cases where minerals were owned by another party under the repealed Act, to the former owner of the minerals. Leases may be transferred to other parties.

The holder of a mineral claim must apply to the Department of Mines for a mining lease within twelve months of registration of the claim.

An Extractive Minerals Lease (20 hectares) entitles the lessee to mine and sell extractive minerals. The Minister is required to give at least 28 days notice, through the Government Gazette, of his intention to grant a mining lease. Protection of the environment and buildings and structures of special or historical interest is considered and included in the terms and conditions under which a mining lease is granted.

Declared equipment *cannot be used in the course of mining operations (including by definition any prospecting) except on a registered claim or land subject to a lease or licence under the Act. A mining operator is required to give written notice, in a prescribed form, of at least 21 days to the owner of the land of his intention to use declared equipment. Provision is made for objection to the use of declared equipment. An Inspector of Mines may direct that ground disturbed by declared equipment be restored to a satisfactory condition.

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* Extractive minerals in the Act means "sand, gravel, stone, shell, shale or clay but does not include fireclay, bentonite or kaolin".

* The following equipment is declared (by Regulation 7) to be "declared equipment" for the purposes of the Act: equipment, generally tractor driven which is capable of ripping, gouging, scooping and digging earth and relatively unconsolidated rock material, and which includes a bulldozer and a tracked hydraulic excavator".

Provision is made in the Act for compensation to be paid by a mining operator to the owner of the land for damage, loss of productivity or profits and other relevant matters arising as a consequence of mining operations. In the case of extractive minerals royalty, amounting to 5% of the value of the minerals, is to be paid through the Minister to the Extractive Areas Rehabilitation Fund. A person who has paid royalty for extractive minerals may receive grants from the Fund for rehabilitation work.

Exploration licences cannot be granted for extractive minerals.

Mines and Works Inspection Act (1920-1970) and Regulations

This legislation is administered by the Mining Branch of the Department of Mines.

All mining operations, including mines, quarries, gravel pits, sand mining operations, proclaimed mines (large civil engineering projects akin to mines) and prospecting operations come within the jurisdication of this Act. Works used for the treatment of the products of any mining are included.

The Inspectors of Mines have wide powers under the Act in respect to; the health, well being and safety of persons employed in or about a mine and of the general public; mining operations which are creating or likely to create a nuisance or damage to property; the effect of any mine, mining operation or practice relating to mining upon the amenity of any area.

The Act empowers the Inspectors of Mines to conduct examinations and enquiries and to issue directions necessary in the interests of health and safety where dangerous conditions exist, to prevent nuisance and damage and to preserve the amenity of an area. Even if regulations do not exist, directions can be given if considered necessary in the interests of health and safety.

Recent amendments have further widened the scope of the Act and the powers of the Inspectors to include matters relating to the amenity and rehabilitation of land disturbed by mining operations.

Regulations 235 and 439 authorise the Chief Inspector to request or order that maps, plans and sections of the deposit and development programmes for all surface works of the mine area be submitted to the Department of Mines for approval.

A person shall not open up a new quarry or rework an old quarry unless he has given at least 21 days notice (in writing) of his intention to the Chief Inspector of Mines and has received the written approval of the Chief Inspector.

Planning and Development Act 1966-1971

This legislation provides for the orderly development of land within the State. The principal Act, which came into operation on 1st July 1967, repealed earlier legislation controlling land use and development.

Three independent authorities were established by the 1967 legislation, which, together with local councils, administer the Act.

The Director of Planning heads the State Planning Office and is primarily responsible for controlling land subdivision and leasing of land.

Broad policies to guide the growth of towns and development of land are determined and controlled by the State Planning Authority comprising 11 members and headed by the Director of Planning.

Appeals against decisions of the Director of Planning, the State Planning Authority or local councils are heard and determined by the Planning Appeal Board.

Under the Act the State has been divided into "planning areas". The Authority is required to examine such areas in conjunction with local councils and to prepare a Development Plan and Report which

indicate the measures considered necessary for orderly development of the area.

After carrying out prescribed procedures for public scrutiny and objection, the proposals with or without amendment, are authorised by the Governor.

Implementation of an Authorised Development Plan includes the preparation of detailed planning regulations which are submitted to the Minister by either the State Planning Authority or the council(s) concerned after a prescribed period of public exhibit and opportunity for objections. Among other matters the regulations may deal with zoning of industrial, commercial and residential areas and define land uses permitted within such zones. Planning regulations submitted by a council are referred to the Authority for a report as to whether they conform with the objects of the authorized development plan.

After approval by the Governor, the regulations are gazetted and become law. A council may administer its own planning regulations. A person aggrieved by a decision given under planning regulations may appeal to the Planning Appeal Board.

Land or buildings may continue to be used for the same purpose that they were being used for at the time that regulations come into effect, even though such use may be contrary to that prescribed by the zoning classification. However, this right lapses if the use is discontinued for a prescribed period.

Land use in the Metropolitan Planning Area, defined in Table 1 overleaf and outlined on the accompanying plans, is guided by the authorized Metropolitan Area of Adelaide Development Plan 1962 and its accompanying Report.

TABLE I

METROPOLITAN PLANNING AREA

Defined as that part of the State that comprises:

(a) the municipalities of Adelaide, Brighton, Burnside, Campbelltown, Elizabeth, Enfield, Glenelg, Henley and Grange, Hindmarsh, Kensington and Norwood, Marion, Mitcham, Payneham, Port Adelaide, Prospect, St. Peters, Salisbury, Thebarton, Unley, Walkerville, West Torrens and Woodville;

(b) the district council districts of Munno Para, Tea Tree Gully, East Torrens, Stirling and Noarlunga;

(c) the area of the Garden Suburb;

(d) the wards known as the Happy Valley, Coromandel, Clarendon, and Kangarilla wards of the district council district of Meadows; and

(e) the portion of the Hundred of Willunga that lies within the district council district of Willunga:

Planning regulations have been gazetted for several council areas the most of the remainder have been approved by the Authority and are under Interim Development Control, as provided for by Section 41 of the Act. Under this procedure, which was established to permit control in the Metropolitan Planning Area while the regulations are prepared for proclamation. consent must be given in writing by the State Planning Authority, or by delegation to the council, for the change of use of any land or buildings or for the construction or alteration of any building.

Under model regulations prepared by the Authority, 19 land zones are established together with 24 specific use groups.

Use groups are either permitted, allowed subject to the consent of the council and the Authority or precluded, for each land zone - see table 2 and 3 overleaf.

Where a use is permitted subject to consent, application must be made to the Authority, or if powers have been delegated, to the council. In the case of the use group Extractive Industry, application is made to the Authority and the Authority is required to consult with the Director of Mines. These applications are referred by the Authority to the Extractive Industries Advisory Committee for investigation and recommendation.

The Metropolitan Development Plan makes provision for a Hills Face Zone extending along the face of the Mount Lofty Range from Gawler to Sellicks Beach (see accompanying plans). Formerly under Interim Control, the Hills Face Zone is now administered by Regulations gazetted on 16th December, 1971.

Provision for existing use applies in this zone and Extractive Industry, as a new use, is subject to consent of the State Planning Authority. Applications for consent are investigated by the Extractive Industries Advisory Committee.

Any consent granted under the Planning and Development Act is also subject to the provisions of the Mining Act, Mines and Works Inspection Act and other Acts.

At the time of writing detailed planning regulations exist only in the Metropolitan Planning area and in Mount Gambier in the South East of the State.

GEOLOGICAL SETTING

The regional geology of the area is shown on the ADELAIDE (Thomson, 1969) and BARKER (Thomson and Horwitz, 1962) 1:250 000 geological map sheets and discussed in detail in Parkin (1969). The account given in this report is sufficient only to provide a broad framework on which the detailed consideration of individual deposits is based.

Planning & Development Act 1966–1971
METROPOLITAN DEVELOPMENT PLAN

(NAME OF LOCAL GOVT AREA)

Planning Regulations–Zoning

ZONING CHART

SECOND SCHEDULE

ZONE NAME	THE NUMBER AT THE HEAD OF EACH COLUMN IS THE USE GROUP NUMBER PARTICULARS OF WHICH ARE SHOWN IN THE THIRD SCHEDULE A BOX BEARING THE LETTER "P" THUS — [P] INDICATES PERMITTED. | A BOX BEARING A DOT THUS — [•] INDICATES SUBJECT TO CONSENT. | A BOX BEARING LETTER "X" THUS — [X] INDICATES NOT PERMITTED.																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
RESIDENTIAL 1.	P	X	X	•	X	X	X	X	X	X	X	X	X	X	X	X	X	•	X	X	•	•	X	X
RESIDENTIAL 2.	P	P	•	P	•	•	•	•	X	X	X	X	X	X	X	X	X	•	X	X	P	•	X	•
RESIDENTIAL 3.	P	P	P	P	•	•	•	•	X	•	X	X	X	X	X	X	X	•	X	X	P	•	X	•
RESIDENTIAL 4.	P	•	•	P	•	•	•	•	X	X	X	X	X	X	X	X	X	•	X	X	•	•	X	•
LOCAL SHOPPING	X	X	X	•	X	P	•	•	X	•	X	X	X	X	X	X	X	•	X	X	•	X	X	X
LOCAL COMMERCIAL	X	X	X	•	X	•	P	P	P	•	•	•	X	•	X	X	X	P	•	X	•	X	X	X
LOCAL OFFICE	X	X	X	•	•	•	•	X	•	P	X	•	X	X	X	X	X	•	X	X	•	X	X	X
DISTRICT SHOPPING	X	X	•	•	X	P	•	•	•	•	•	•	X	X	X	X	X	•	•	X	P	X	X	X
DISTRICT COMMERCIAL	X	X	X	X	X	•	•	P	P	P	P	•	•	•	X	X	X	P	P	•	P	X	X	X
DISTRICT BUSINESS	X	X	•	•	•	P	P	P	P	P	P	P	•	•	X	X	X	P	P	•	P	X	X	X
CENTRAL BUSINESS	X	X	•	•	•	P	P	P	P	P	P	P	•	•	•	X	X	P	P	•	P	X	X	X
LIGHT INDUSTRY	X	X	X	X	X	•	•	P	P	•	•	X	X	P	•	X	X	P	•	•	P	X	X	X
GENERAL INDUSTRY	X	X	X	X	X	•	•	P	P	•	•	X	X	P	P	X	X	P	•	•	P	X	X	X
SPECIAL INDUSTRY	X	X	X	X	X	•	•	•	•	•	X	X	X	•	•	P	X	P	•	•	P	X	X	X
EXTRACTIVE INDUSTRY	X	X	X	X	X	•	•	•	•	•	•	X	X	X	X	X	P	P	X	•	P	•	X	P
RURAL "A"	•	X	X	X	P	•	•	•	•	•	X	•	•	•	•	•	•	P	•	•	P	P	P	P
RURAL "B"	•	X	X	X	•	•	•	•	X	X	X	X	•	X	X	•	•	•	•	•	P	P	P	P
COUNTRY TOWNSHIP	P	P	P	P	•	•	P	•	•	P	•	P	X	•	X	X	X	P	•	X	P	P	•	P
SPECIAL USES	X	X	X	X	•	X	X	X	X	X	X	X	•	X	X	X	•	•	X	•	P	P	P	P

FROM: MODEL PLANNING REGULATIONS ZONING – METROPOLITAN
STATE PLANNING AUTHORITY, M.P.R. SERIES No.1
AUGUST 1971

FIG. 2

Planning and Development Act, 1966-1971
METROPOLITAN DEVELOPMENT PLAN

(NAME OF LOCAL GOVT. AREA)

Planning Regulations—Zoning

USE GROUP TABLE

THIRD SCHEDULE

USE GROUPS

1	2	3	4	5	6	7	8
Detached Dwellinghouse	Semi-Detached Dwelling-house	Residential Flat Building Multiple Dwelling Boarding-house Row Dwelling-house	Primary School Health Centre Community Centre Meeting Hall Place of Public Worship Police Station Library	Educational Establishment Hospital Welfare Institution	Shop Shop and Dwelling-house	Hotel Motel Residential Club Non-Residential Club Private Hotel	Petrol Filling Station

9	10	11	12	13	14	15	16
Builders Yard Warehouse Store Timber Yard Service Industry	Post Office Bank Office Office and Dwelling-house Consulting Rooms Radio or T.V. Studio	Motor Showroom Used Car Lot Auction Rooms	Dance Hall Skating Rink Exhibition Hall Bowling Alley Amusement Hall Theatre Concert Hall Squash Court Gymnasium Billiard Saloon	Amusement Park Fun Fair Stadium Race Course Drive-in Theatre Show Ground Dog Track Motor Race Track Golf Driving Range	Light Industry Motor Repair Station	General Industry	Special Industry Abattoir Refuse Destructor

17	18	19	20	21	22	23	24
Extractive Industry	Electricity Substation Pumping Station Over 100 h.p. Service Reservoir Minor Public Service Depot Telephone Exchange Temporary Sewage Treatment Plant	Fire Station Bus Depot Road Transport Terminal Bus Station Harbour Installation	Permanent Sewage Treatment Plant Waterworks Reservoir Defence Establishment Major Public Service Depot Transmitting Station Electricity Generating Station Gas Holder Marshalling Yard	Recreation Areas	Golf Course	Cemetery Crematorium Caravan Park	Agriculture Plant Nursery Agistment and Holding of Stock Airfield Stock Saleyard

FROM: MODEL PLANNING REGULATIONS ZONING – METROPOLITAN STATE PLANNING AUTHORITY, M.P.R. SERIES No.1 AUGUST 1971

FIG. 3

The Mount Lofty Ranges owe their present morphology to block faulting, oriented northeast to north, which began in the early Tertiary period and which has continued right up to the present, producing the graben-horst structure of the ranges and the flanking St. Vincent (west) and Murray (east) Basins.

The elevated fault blocks of the Mount Lofty Ranges are made up of four major groups of rocks, each differing in age and lithology, and referred to as bedrock. Younger sediments, mainly unconsolidated, mantle bedrock in various parts of the area.

Sedimentary rocks of Upper Proterozoic age occupy the western side of the Range and are known as the Adelaide System. The sequence comprises mainly argillaceous rocks (shales, slates, phyllites) with interbedded sandstone, quartzite, dolomite and limestone units.

The Adelaidean rocks overlie metasediments of Lower Proterozoic age referred to locally as the Barossa Complex. Only small inliers of these rocks, elevated by faulting, are exposed in the Houghton and Crafers areas.

Lower Cambrian Hawker Group sediments, including important limestone deposits, occur along the western coast of Fleurieu Peninsula.

The eastern Mount Lofty Range is underlain by a thick sequence of metamorphosed sedimentary rocks known as the Kanmantoo Group, of Middle Cambrian age. The Kanmantoo Group were intruded by granitic rocks in the lower Ordovician.

Glacial conditions prevailed over southeastern Australia in the early Permian and clays, sands and boulder beds were deposited over southern Fleurieu Peninsula during this time. The sequence is known as the Cape Jervis Beds.

During the Tertiary, sediments were deposited under marine conditions on the down faulted blocks of the flanking basins and in a fresh water lacustrine environment on the peneplaned surface of the ancestral Mount Lofty Range. These sediments have remained largely unconsolidated except for a capping of ferricrete or silcrete which developed during the Middle to Late Tertiary. Deep weathering accompanied the development of this capping and the hard slates and phyllites of the Cambrian and Proterozoic sequences were converted to soft clay shales for up to 100ft. below the weathering surface.

Tertiary sediments occur on the highlands as thin erosional remnants and in a thick flat lying sequence beneath the Adelaide Plains and the Willunga and Noarlunga Basins.

The sedimentary record of the Quaternary is widespread and diverse with the lithology of units equated in time being determined by their position in the landscape. Thus sands and clays were deposited on the plains concurrently with the accumulation of gravels on the steeper slopes adjacent to the ranges and the development of soil profiles and terrestrial deposits on the highlands.

CONSTRUCTION MATERIALS

Included in this discussion are; clays used in the heavy ceramic industries for the manufacture of bricks, pipes, roofing tiles and lightweight aggregate; coarse aggregate for concrete and road construction; sand for filling and fine aggregate in concrete; rock for filling on roadworks and construction sites; building, ornamental and monumental stones.

The quarries have a varying impact on the amenity of the area surrounding them.

The greatest effect in respect to noise and dust is from the aggregate quarries as a consequence of the need to blast and crush formations of sufficient hardness to produce material of the required physical properties.

Clay and sand occur in relatively soft formations and can usually be won by earthmoving equipment and prepared for use by processes which do not create noise and dust to any degree.

The quartzite and sandstone quarries generally appear as prominent white scars in the landscape and are visible from considerable distances, while in contrast the carbonate aggregates, being usually dark blue and grey in colour, form working faces that merge well with the surrounding land and are visible only from relatively close range. In this respect the carbonate rocks are a superior source of aggregate to the quartzites and sandstones.

Examination of air photographs of the western Mt. Lofty Range reveals that generally a natural separation exists between the closely settled horticultural areas and the existing extractive industries. In particular the aggregate quarries, which have the most impact on the amenity, are located on land which is not suitable for agriculture and are thus separated from the indigenous population.

It is noticeable that the principal encroachment into the virgin scrub areas, where resources of aggregate for future generations are located, is from new residential development not directly connected with the local rural industries.

Table 4 below shows the quantity of the major construction materials produced for Adelaide and the metropolitan area in the calendar years 1969-1971. It does not include roadworks materials used by District Councils. Figure 1, referred to earlier, illustrates the growth in consumption of these materials over the last 26 years.

TABLE 4

Production of Construction Materials
Used in the Adelaide Area 1969-1971

	1969	1970	1971
		MILLIONS OF TONS	
Clay	0.76	0.71	0.72
Coarse aggregate	4.11	4.13	4.57
Sand	1.40	1.64	1.54
TOTAL	6.27	6.48	6.83

Construction materials resources have not been investigated in sufficient detail to identify all potentially useful deposits. However the general geological setting is sufficiently well established to indicate the geological formations in which future requirements will be found, and as a consequence, to recognise the materials which will soon be in short supply.

The accompanying plans show the producing and potentively productive formations and the location of working pits.

Clay

Heavy ceramic products consist of bricks, roofing tiles, sewer and drainage pipes.

Building bricks account for approximately 85% of the heavy clay products and it is generally accepted that 4 to 4½ tons of clay are required per 1 000 bricks.

Brick sales in Adelaide area are shown in Figure 2 based on figures supplied by the S.A. Clay Brick Association for the years 1962-71 and on Willington (1956) for brick production over the years 1908-1954. The graph shows the sensitivity of brick and, by inference, pipe and tile consumption, to prevailing economic conditions but a general upward trend is recognisable.

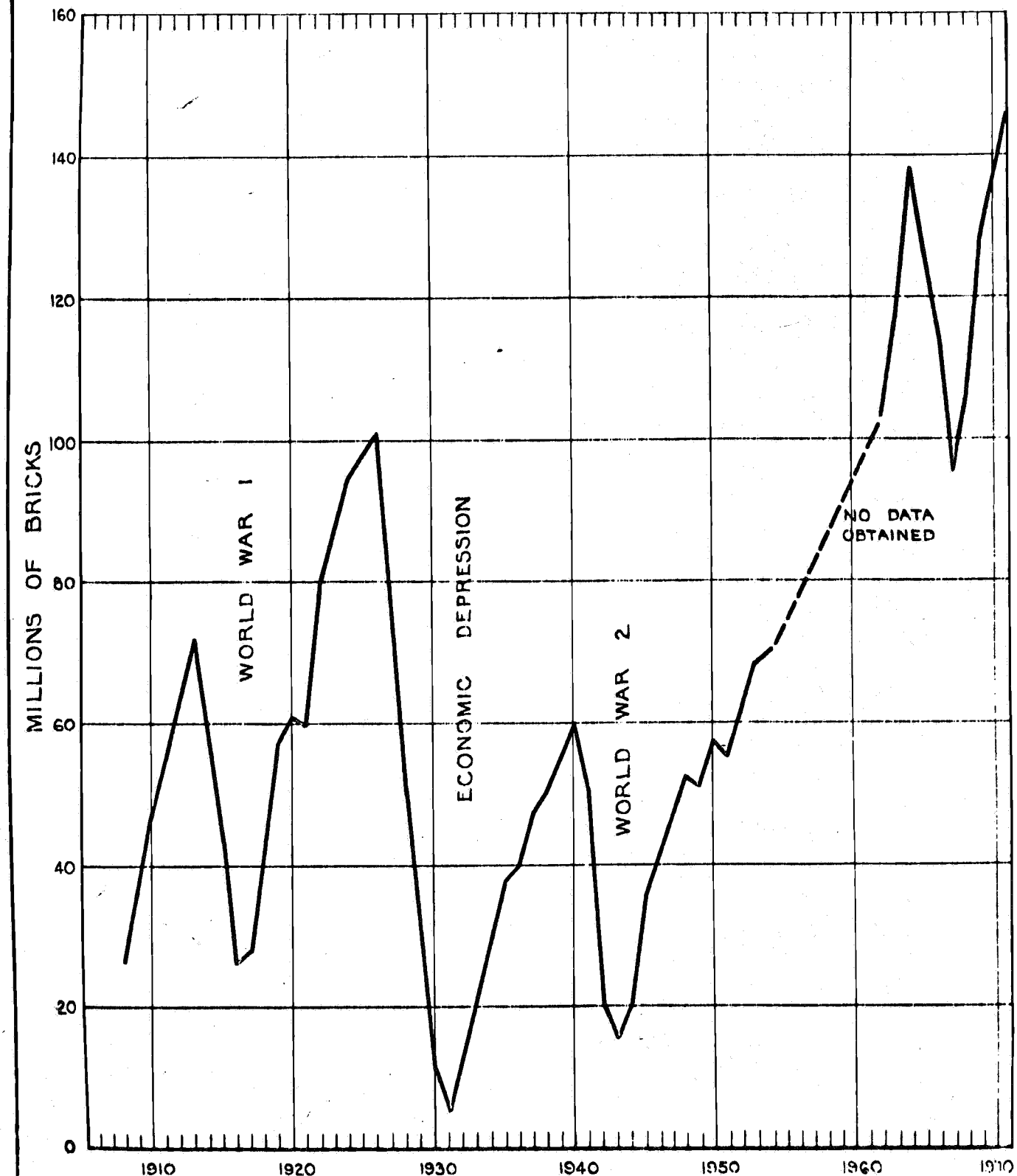

FIG. 2

Compiled: M N HIERN Drn SLT ; Ckd L.V.W.	DEPARTMENT OF MINES – SOUTH AUSTRALIA ADELAIDE METROPOLITAN AREA BRICK MANUFACTURE 1908 – 1971	Scale: Diag. Date 13 April '72 Dwg No. 72 – 191 GH

Clay production for the years 1969-1971 is shown in Table 5.

TABLE 5

CLAY PRODUCTION - METROPOLITAN AREA 1969-1971 (tons)

	1969*	1970*	1970**	1971*
White plastic clay	105 000	98 000	170 000	116 000
Red plastic clay	52 000	48 000	52 000	42 000
Brown shale	358 000	311 000	330 000	271 000
White shale	75 000	85 000	164 000	120 000
TOTAL	590 000	542 000	716 000	549 000

* Figures from production returns.

** Figures compiled from survey of industry by A.T. Armstrong - 1971.

On Table 4, the 1969 and 1971 totals comprise recorded production plus 0.17 million tons (difference between 1970** and 1970* above).

The two properties of clay utilised most in the heavy ceramic industry are fired colour and plasticity. The former has little affect on the properties of the ware but is important in respect to consumer demand. Cream bricks comprise about 30% of all bricks produced.

Fired colour is a function of the chemistry of the clay and thus its origin. In general the white clays fire to an off-white or cream colour and the coloured clays fire to various shades of red and brown. Plastic clays give workability and strength to the green ware but clays of high plasticity invariably undergo cracking, distortion and shrinkage during firing. Thus modern heavy clay product plants in South Australia use a blend of plastic and non-plastic clays to produce acceptable ware within a wide colour range.

Clays available in the Adelaide area are discussed below.

White Plastic Clay

Clays of this type form the basis of the cream brick manufacturing industry. Resources are not large, being restricted to the freshwater Tertiary formations. Tertiary sediments in the Golden Grove - Highbury area have the best known development of such clays. Total life of the deposits is not known but is probably only in the order of 10 years at present consumption rates. The basin is of restricted area and some of the resources are unavailable because of the spread of housing estates and zoning regulations.

Thin beds of white clay occur near the base of the Tertiary sand deposits in the Willunga Basin but on present evidence these units are unlikely to contain appreciable reserves.

The Tertiary formations of the highlands are the remaining potential sources of white firing plastic clays. Small deposits are known at One Tree Hill (Section 4357, Hundred Munno Para) and in the Sandy Creek area. The remaining Tertiary remnants have not been investigated in sufficient detail to determine how extensively the white clays are developed.

Red Plastic Clay

These are abundant in the Quaternary formations of the plains and also in the northern parts of the Barossa Valley, Calcareous soil horizons frequently render the upper few feet unusable and rapid facies changes to sandy and gravelly units often require selective mining.

Useful red and black plastic clays occupy the flats of many of the drainage channels in the ranges and these sources provide clays of high plasticity necessary for roofing tile production. Small quantities of clay of this type will always be required for special purposes and to serve the smaller brickworks in the ranges. It is thought that adequate resources are available.

A further source of plastic clay is from the slime dams associated with sand washing plants, particularly those processing Tertiary sands. This material is not used to any extent at present, largely because of technical problems associated with dewatering.

White Shale

This material, together with white plastic clay, forms the basis of the cream brick industry. The reserve situation is not as critical as that for white plastic clay but there is concern in the industry about adequate reserves in the long term.

Present supplies are won from deposits near Anstey's Hill (Section 5405, Hundred Yatala), One Tree Hill (Section 4357, Hundred Munno Para) and from an area north of Birdwood. Deposits in the latter area usually contain sufficient vanadium to cause an undesirable green colouration on bricks if not fired correctly.

Further reserves of white shale are required. These and the brown shales are products of a Tertiary weathering profile which, where fully preserved, consists of an upper zone of white shale passing down into a much thicker zone of brown shale. Some future resources of white shale will thus be found in the higher portion of the ranges where the full weathering profile has been preserved from erosion. In particular the areas capped by Tertiary sediments are most favourable and it is therefore likely that supplies of both white plastic clay and white shale will be confined to the same area (as at One Tree Hill). This simple model of white shales being confined to the highest parts of the ranges is modified by the Tertiary block faults and useful deposits will therefore also be found at lower elevations, particularly in the section of ranges nearest to the plains. Quartz reefs and iron staining are the principal deleterious features of these deposits.

The Adelaidean argillaceous rocks were the most susceptible to alteration to clay shale. There is evidence of the existence of a zone of moderately refractory white clays occurring along the Adelaidean-Kanmantoo Group contact from Birdwood to at least as far south as Nairne.

Brown Shale

The Mount Lofty Ranges contain large reserves of weathered shale in the Adelaidean which fires to various shades of red and brown. Further, the partially weathered parent material can be used in brick manufacture as is practised by City Bricks at Glen Osmond.

Further investigation is merely a matter of locating those resources most economically situated to existing and future brick plants and in planning to preserve the amenity.

Coarse Aggregate

Crushed rock is used as coarse aggregate in concrete and in road construction for basecourse and bitumen surfacing. Specifications vary, particularly in size ranges, but generally call for sound durable material free of deleterious substances and an absence of flakey or elongated particules. For road base work a proportion of fines is required to provide workability but fines are undesirable for both concrete and road surfacing work.

Supplies of coarse aggregate for use in the Adelaide area are won from sandstones, quartzites, limestones and dolomites of the Adelaidean sequence in the Mount Lofty Range. Bitumen surfacing materials consist exclusively of the carbonate rocks limestone and dolomite on account of better particle properties. Quartzite and carbonate rock aggregates are both used in concrete, the choice to some extent depending upon contractor prices but it is believed that of the aggregates available, those derived from carbonate rocks give greater load bearing capacity. As larger structures are built, specifications will call for stronger concrete and it is likely that demand for the high quality carbonate aggregates will increase in the future.

Tables 6 and 7 below are reproduced from an analysis by Jones (1968) who showed that the production of coarse aggregate from 5 companies quarrying in the Hills Face Zone (i.e. the major metropolitan supplies of coarse aggregate) was used in 1967 in the following proportions.

TABLE 6

TOTAL ANNUAL PRODUCTION 1967

	WEIGHT TONS	VALUE $	% BY WEIGHT
Roadmaking materials	2 575 000	2 834 000	65
Concrete materials	905 000	1 357 000	23
Other materials	496 000	533 000	12
TOTAL	3 976 000	4 724 000	

TABLE 7

TOTAL PRODUCTS USED ANNUALLY 1967

	WEIGHT TONS	VALUE $	% BY WEIGHT
Government Departments	1 046 000	1 122 000	26
Local Government & State Instrumentalities	975 000	1 002 000	25
Road making Contractors	527 000	676 000	13
The Building Industry	779 000	1 093 000	20
Commercial and Industrial Firms and other users	649 000	831 000	16
TOTAL	3 976 000	4 724 000	

Note - percentages added by author.

Table 8, overleaf, shows production of coarse aggregate for the calendar years 1969-71 from quarries supplying the Adelaide area.

TABLE 8

COARSE AGGREGATE PRODUCTION - METROPOLITAN AREA 1969-1971 (tons)

	1969	1970	1971
Dolomite	812 000	835 000	946 000
Limestone	413 500	622 000	651 000
Quartzite	2 879 000	2 669 000	2 977 500
TOTAL	4 104 500	4 126 000	4 574 500

All of the quartzite and sandstone and approximately half of the carbonate aggregates are won from the ranges to the east of Adelaide. These come principally from large quarries near the western face of the range within the Hills Face Zone. The remaining carbonate aggregates are won from the Marino-Reynella area.

The principal quartzite and sandstone beds in the Mount Lofty Ranges are shown on the accompanying plans (72-483, 484, 485, 486) and it is evident that large quantities of these materials exist. Little work has been done to evaluate the beds outside of the immediate environs of the producing quarries and much detailed sampling is necessary to determine their suitability for aggregate. However, even at this stage it can be said that large reserves exist for the future if quarry sites are available.

Carbonate rocks are not so widely distributed and action to set aside adequate reserves for the future is more urgent, particularly in view of the better physical properties of the carbonate aggregates.

Present production is won from two main areas. Blue dolomite is won from the Riverview and Montacute quarries located near the Torrens Gorge and the remaining beds of dolomite in this area should immediately be set aside for extractive industries. Limestone beds extending from Marino to Reynella are the other present source of carbonate rocks but much of the land underlain by these rocks has been developed or zoned for housing.

High quality limestone and dolomite occur in the Willunga escarpment in the Cambrian sequence from Sellicks Hill southwards. The Brighton Limestone in the same area may also contain workable deposits. The beds are not worked at present but some quarry sites are known to exist around Sellicks Hill. Detailed investigation is required to identify all suitable sites after which action should be taken to reserve sufficient material for the future (Pain and Hiern, in press).

Adelaidean limestone and marble in the vicinity of Woodside and Cambrian marble south of Macclesfield and around Angaston provide potential sources of bitumen surfacing and other aggregate material in these areas. Further investigation of these is proposed.

Only small quantities of lightweight aggregate are used by the building industry at present and requirements are brought from interstate. Recent testing by AMDEL has demonstrated that suitable raw materials for the manufacture of expanded aggregate occur in the Mount Lofty Ranges (Nichol, 1972).

Sand

Only those materials for which standard specifications are applied are considered in this section - i.e. sand for concrete and cement bricks, mortar, foundry and specialised filling purposes. General filling materials for roadworks and construction sites are discussed in a following section.

Concrete and mortar sands are won from the Tertiary sequence, the principal present sources being in the Maslins Beach and Golden Grove areas and the Gawler - Lyndoch district. The naturally occurring sands invariably contain too much clay to meet specifications and washing plants are used to produce an acceptable product. Artificial sands are produced at two of the coarse aggregate quarries by processing of fines from the crushers, particu-

larly at quartzite deposits where the formation being quarried contains intercalated bands and lenses of friable sandstone which are unavoidably included in the crusher feed.

Fine sands for filling and foundry use are won from Quaternary units, particularly the dunes and associated sand spreads of the Adelaide Plains and Happy Valley area. Small quantities of foundry sand are produced from near Sandy Creek.

Many of the deposits are described by Olliver and Weir (1967).

Sand production for the metropolitan area in the years 1969-1971 is shown in table 9 below.

TABLE 9

SAND PRODUCTION - METROPOLITAN AREA 1969-1971 (tons)
CONSTRUCTION SAND (including production recorded as gravel)

	1969	1970	1971
Maslins Beach Area	238 000	385 000	429 500
Golden Grove - Highbury	571 000	542 000	596 000
Gawler - Lyndoch	364 000	398 000	290 000
Hd. Munno Para	10 000	2 000	-
TOTAL NATURAL SAND	1 183 000	1 327 000	1 315 500
Quarry sand	69 000	112 000	100 000
TOTAL CONSTRUCTION SAND	1 252 000	1 439 000	1 415 500
FILLING SAND			
Grange area	127 000	85 000	79 000
Happy Valley area	112 000	102 000	50 000
Other areas	7 000	11 000	-
TOTAL FILLING SAND	246 000	198 000	129 000
TOTAL SAND	1 498 000	1 637 000	1 544 500

Tertiary formations will be the principal source of construction sand for the Adelaide area in the future. The deposits at Golden Grove and Maslins Beach are limited by geological features and particularly at Golden Grove land underlain by sand deposits is becoming unavailable because of the spread of housing and zoning regulations.

The Gawler-Lyndoch area is already a major producer of sand and is the principal known source of future requirements. The sand producing potential of Tertiary beds elsewhere in the highlands is not known in sufficient detail at present and further investigation is required. In particular little is known of the Tertiary units in the highlands east of Willunga. One deposit (Section 249, Hd. Nangkita) has been shown by drilling to contain sand which, with washing, should produce a suitable building sand (Olliver, 1965).

It seems desirable to have a source of supply in this area to cater for southward housing expansion.

Plastic clay and white shale for brick making purposes are usually associated with the Tertiary sand beds and an opportunity exists to establish major sources of supply of all three materials in the one area.

The major source of filling and foundry sand (at Grange) was lost to the industry with the initiation of Westlakes Development Scheme. Fine grained sands suitable for these purposes occur generally as a veneer over the coarser Tertiary sands. The working deposits at Happy Valley have limited life and other dunes in the area are generally developed for housing and vineyards. Further investigation of fine sands overlying the Tertiary in the Willunga Basin and the Gawler-Lyndoch area might disclose additional resources of filling sand. Extensive dunes occur on the plains north of the Gawler River and smaller ones near Outer Harbour and on Torrens Island. A potential source exists under water in the reaches of the river around Pt.

Adelaide, off-shore along the whole of the metropolitan beaches and beneath the tidal flats around the mouth of the Little Para River.

Some artificial sand is produced as a by-product from the coarse aggregate quarries and if effective control of effluent water can be achieved, this source might be expanded in the future. It is believed that many of the sandstone units of the Adelaide System, particularly the Aldgate Sandstone, may be sufficiently friable to set up plants specifically to produce artificial sand. Further investigation of this source is necessary.

Building and Monumental Stone

Marble from the Angaston and Kapunda areas has long been a source of monumental and building stone and production continues from a number of small quarries. Marble chips for terrazo work are also produced.

The Macclesfield area also has marble suitable for monumental purposes.

Argillaceous sandstone with attractive vari-coloured banding is used in suburban house construction and numerous small quarries in the ranges produce sawn blocks for this purpose.

Production of slate and flagstone from the Darlington and Willunga areas has declined considerably but these areas still contain large reserves of this material. A deposit at Mintaro is also an important producer.

Red and grey granite has been produced from the Murray Bridge and Victor Harbour areas and a biotite-norite, referred to in the trade as Black Imperial Granite, is won from the Hd. of Ridley, a few miles east of Cambrai.

Jack (1923) describes many of these deposits in detail.

Production of building stone within 100 miles of Adelaide for the years 1969-1971 is shown in Table 10 overleaf:-

TABLE 10

BUILDING STONE PRODUCTION - YEARS 1969-1971 (tons)

	1969	1970	1971
Marble	2 680	2 690	5 150
Granite	-	4 500	5 120
Sandstone	8 620	9 090	8 180
Slate	2 900	3 480	2 030
TOTAL	14 200	19 760	20 480

Rock Filling

Large quantities of rock materials are used for filling in major roadworks and for surfacing of unsealed country roads. These are necessarily low cost materials and are won by ripping and bulldozing from sites adjacent to roadworks. Numerous shallow pits exist throughout the ranges, many of them owned by local government bodies, which are worked from time to time as new roadworks or resurfacing are required.

All major roadworks such as freeways require large quantities of fill. Much of this is obtained from cuttings and excavations associated with the facility itself but material from external sources is often required. Large quantities of suitable filling material are available, including material occurring in and adjacent to existing and abandoned quarries as overburden, wall rock and in discarded waste heaps.

SUMMARY AND CONCLUSIONS

Construction materials resources for the metropolitan Adelaide occur in sedimentary sequences whose extent and limits are well defined, on a regional scale, by published mapping of the Geological Survey.

The accompanying plans show the extent of the various productive and potentially productive geological formations and provide a basis for systematic evaluation.

Although no inventory of total resources or even estimates of the combined life of existing quarries is available at the present time, sufficient is known to indicate which materials are or will in the short term be in short supply.

A variety of clays are used in the manufacture of building bricks, sewer and drainage pipes and roofing tiles. The present sources of some of these are rapidly becoming depleted and the geological formations which are most likely to contain future reserves are restricted in their distribution.

Tertiary sediments provide the main potential future source of white plastic clays and also construction sands. They are frequently underlain by white shale. Concern exists in the industry for future sources of all of these materials. A detailed investigation of Tertiary remnants in the ranges is necessary to define usable deposits. In the meantime all areas of Tertiary sediments shown on the accompanying maps, particularly the Sandy Creek-Lyndoch area should be recognised as important for future extractive industries. White shales are associated with the Adelaidean-Kanmantoo Group contact in the Birdwood area and there is evidence that this zone extends as far south as Nairne.

Large reserves of red and brown shale exist in the weathered argillaceous rocks of the ranges, particularly the Adelaidean.

The main sources of red plastic clay occur on the plains flanking the ranges and it is expected that detailed investigation will disclose adequate reserves. The presence of carbonate soil horizons and interbedded gravels requires selective quarrying in some instances.

Quartzite formations believed to be suitable for coarse aggregate are widespread in the ranges and with further detailed work it will be possible to identify reserves for the future at sites which will have minimum effect on the environment.

Carbonate rocks (limestones and dolomite), which are superior in many respects to quartzite and essential for road surfacing, are more restricted. Immediate steps should be taken to reserve the formations in the Torrens Gorge area. Detailed investigation of the Sellicks Hill area is necessary to locate deposits which can be worked out of sight from the Willunga Plains. The limestone and dolomite quarries are visible only from relatively close range because of the blue-grey colour of the rock.

Construction sands are mainly confined to Tertiary freshwater beds. Two of the three principal producing areas are limited by geological features and spreading housing development. Tertiary sediments in the Gawler-Lyndoch area are an established source of supply and are important future resources which should be reserved for extractive industry. Other areas of Tertiary sediments, particularly south of Adelaide require investigation.

Known resources of filling and foundry sand in close proximity to Adelaide are thought to be limited but several potential sources exist.

Adequate reserves of building stones and rock fill exist.

M.N. HIERN
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MNH:FdeA
24.8.72

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INDEX TO QUARRIES FOR CONSTRUCTION MATERIALS
GAWLER 1:63 360 sheet (refer to Plan 72-482)
Preliminary Compilation

INDEX NO.	LOCATION		OWNER OR OCCUPIER	PROJECT
	HUNDRED	SECTION		
G 1	Mudla Wirra	1	Hallett Brick Industries	Clay
2	Nuriootpa	11	Disused	Sand
3	Barossa	3081/2	Reids Gawler Sand	Sand
4	"	3094	L.R. & M. Sands Pty. Ltd.	Sand
5	"	3036-7	L.R. & M. Sands Pty. Ltd.	Sand
6	"	3058,3059 3060	Monier Sands	Sand
7	"	475	L.M. Barry	White shale
8	"	86	J.S. Williams	Fine sand
9	"	70	Sampson	Fine sand
10	"	73	Reids Gawler Sand	Sand
11	"	71	Disused	Sand
12	"	94	"	Sand
13	Nuriootpa	845	H.R. Roesler & Son	Sand
14	"	845	" " "	Sand
15	"	1620	C.R. Heuppauff	Sand and clay

G 16	Nuriootpa	1620	C. Bartsch - not in use	Sand
17	Barossa	587	Readymix Concrete (R.M.C.)	Sand
18	"	588	" " "	Plastic clay
19	Munno Para	3303	Quarry Industries - Smithfield	Aggregate - quartzite
20	"	3261	C.R. Reid Pty. Ltd.	Sand
21	"	4357	Geo Denton	Sand, clay.
22	"	4357	Clay & Mineral Supplies	White clay.
23	"	3270/1	Quarry Industries - Salisbury	Aggregate - quartzite
24	Barossa	1001	A.M. Roes	Gravel
25	"	950	Aust. Industrial Minerals N.L.	Fireclay
26	Munno Para	3324/5	Quarry Industries - closed	Aggregate - quartzite
27	"	6381	Clay & Mineral Supplies?	Clay?
28	Barossa	68,476	" " "	Clay

INDEX TO QUARRIES FOR CONSTRUCTION MATERIALS

Refer to Plan 72-483

ADELAIDE 1:63 360 sheet

Preliminary Completion

INDEX NO.		LOCATION		OWNER OR OPERATOR	PRODUCT
		HUNDRED	SECTION		
A	1	Yatala	2102	Quarry Industries - closed	Aggregate - quartzite
	2	"	2147	S.A. Sand & Washed Metal?	Sand and gravel
	3	"	5470	Clay & Mineral Supplies	Plastic clay, filling sand
	4	"	5469	L.G.S. Lange - closed	Filling sand
	5	"	2158,5460 5465	Monier Sands ex. C.R. Reid	Sand
	6	"	5467	Monier Sands	Sand
	7	"	5477	Hallett Brick Industries	Brown shale
	8	"	5461	Builders Bricks P.G.H.	Shale
	9	"	5662	" " "	Shale
	10	"	5459	Geo Denton	Sand, shale, plastic clay
	11	"	5458	S.A. Washed Sand - ex C.R.Reid	Sand
	12	"	2166,5661	A.J. Strachan - now Christies Sand	Sand
	13	"	1560	C.R. Reid?	Gravel, sand

A 14	Yatala	1560	S.A. Washed Sand & Metal	Sand
15	"	5449	Hallett Brick Industries Poultons pit	Shale
16	Para Wirra	1044	D.C. Gumeracha	Gravel, rubble
17	Talunga	4	Clay & Mineral Supplies	White shale
18	"	1	Hallett Brick Industries - operated by Clay & Mineral supplies	" "
19	"	1	Fargo Earthmovers	" "
20	"	6397	Newbold General Refractories	" "
21	"	"	" " "	Silica, also D.C. Road-metal quarry
22	"	6641	Quarry Industries	Aggregate, quartzite
23	Yatala	844	Clay & Mineral Supplies	Shale
24	"	845,846	Christies Sand	Sand, plastic clay
25	"	5630,5633	Quarry Industries	Aggregate - quartzite
26	"	5532	Wilmington Mining Co.	Sand
27	"	5398	" " "	Shale
28	"	820	Moule A.R.	Sand
29	"	820	W. Duhne & Sons	Sand ?Shale
30	"	821	Mercer	Sand
31	"	5392	L.G.S. Lange	Sand, rubble

A 32	Yatala	5394/5, 5407	Pearce Transport - new Clay & Mineral Sales	Sand, rubble
33	"	5626	Est. A.C. Couls	Sandstone
34	"	5394	R.M.C.	Aggregate - quartzite
35		5548	R.M.C.	Aggregate - dolomite
36		5404	Francis Bros.	White shale
37	Onkaparinga	330-332	Montacute Blue Metal	Aggregate - dolomite
38	"	190	Onkaparinga Brickworks	Shale
39	"	5213	D.C. Onkaparinga	Gravel
40	Adelaide	342,849	Gilburn Brick Co.	Shale
41	"	1107/9/10, 1180	White Rock Quarries	Aggregate quartzite washed sand
42	Onkaparinga	4240	E.G. Bell	Fireclay, shale
43	"	3966	Langbein Transport Co.	Fireclay
44	"	163	Rockfell Quarries	Aggregate - quartzite, ?dolomite
45	"	4246	D.C. Onkaparinga	Aggregate - limestone
46	Adelaide	1050A,1057, 1176	Quarry Industries - Stonyfell	Aggregate - quartzite
47	"	1051/2,1056/7	" " Greenhill	" "
48	Onkaparinga	969	Adelaide Cement Co.	Shale

A 49 50 51 52	Onkaparinga	130,135	Various	Building stone-sandstone
53	Adelaide	1079	City Bricks	Shale
54	"	922,946	Quarry Industries - Eagle Quarry	Aggregate - quartzite
55	"	961	City Bricks - Crafers	Shale
56	Onkaparinga	120	L.S. Foal	Building stone - slate
57	"	1204	D.C. Stirling	Aggregate
58	Adelaide	5660,284,310	Bide Estate	Sand, gravel
59	"	47	Hallett Brick Industries	Red plastic clay
60	Yatala	373	Barreys Bricks	" " "
61	"	390	Hallett Brick Industries	" " "
62	"	394	Willis & Williams - closed	" " "
63	"	395	Frehburgs Bricks	" " "
64	"	371	Rocla Pipes	" " "
65	"	374	P.G.H. Industries - closed	" " "
66	"	722	Grange Golf Club	Filling sand
67	"	927	P.W. Ellis from stockpiles only	" "
68	"	453	H.G. Oke	" "

INDEX TO QUARRIES FOR CONSTRUCTION MATERIALS

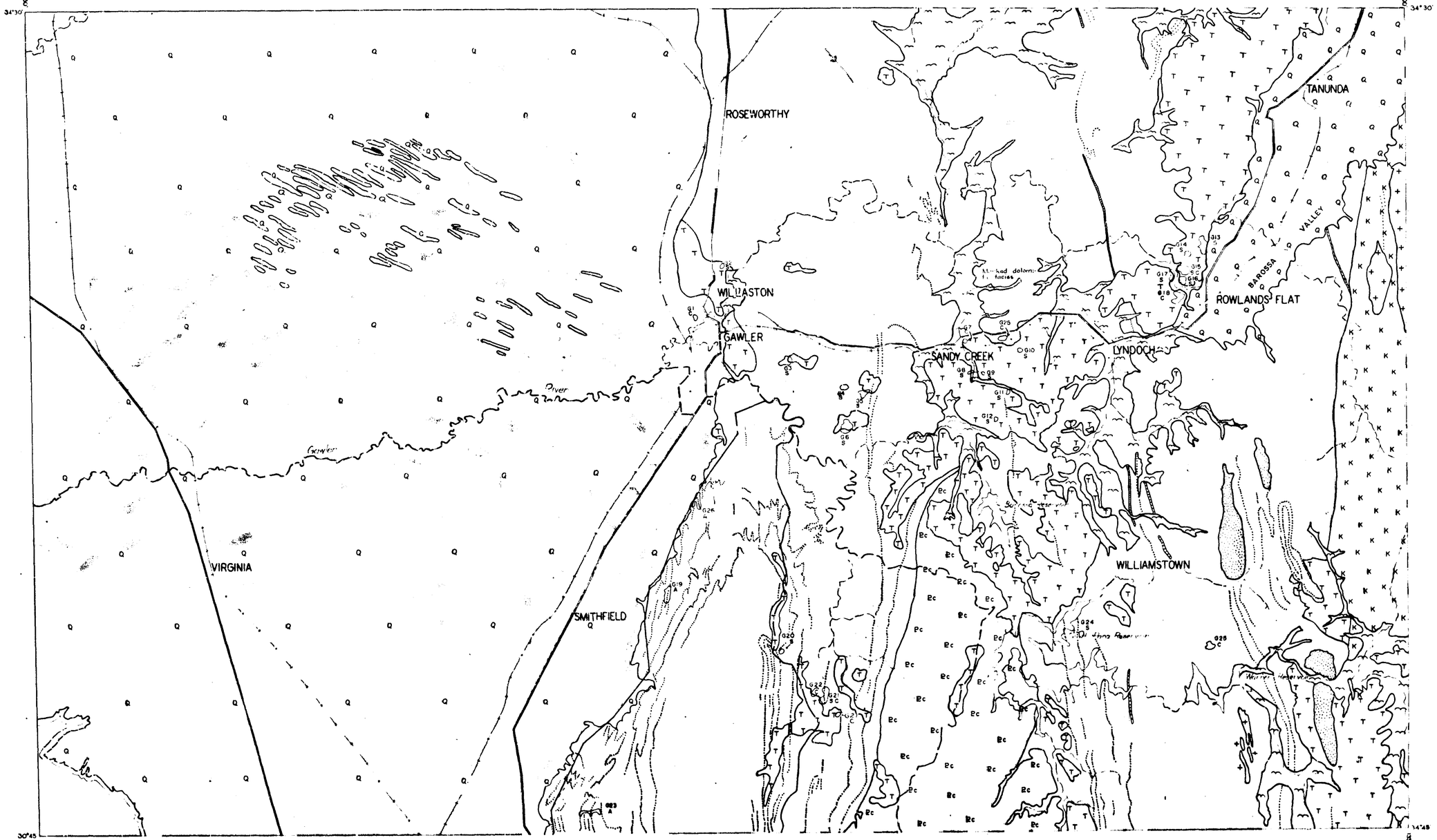
Refer to Plan 72-484

ECHUNGA 1:63 360 sheet

Preliminary Compilation

INDEX NO.	LOCATION		OWNER OR OPERATOR	PROJECT
	HUNDRED	SECTION		
E 1	Noarlunga	197,215	Quarry Industries - Linwood Quarry	Aggregate - limestone
2	Adelaide	1087	Broadview Quarries	Aggregate quartzite Sand
3	Noarlunga	401,402	V. Pistola	Building Stone
4	Macclesfield	5009	J.A. Childs and Son	Shale
5	"	84,4485,5009	Littlehampton Brickworks	Shale, plastic clay
6	Noarlunga	326,328,331	Bradbury	Shale, fireclay
7	"	786	Wunderlich - J. Benbow & Son	Shale
8	"	783	" " "	Plastic clay
9	"	785,1080	J. Hallett and Sons	Shale
10	"	796	W.E. & V.L. Nicolls	Sand filling
11	"	276	" " "	" "
12	"	432	H.J. Brady	" "
13	"	432	Hayes Sand Supplies	" "
14	"	501	J. Hallett & Son	Shale - white

E 15	Noarlunga	519,533	Quarry Industries Reynella	Aggregate - limestone
16	"	515,529	All Purpose Sands	Sand
17	"	232,1396	C.F. Mitchell	Fireclay
18	Kuitpo	357	Clay & Mineral Supplies	Shale
19	"	716	Wunderlich - J. Bendow & Sons	Clay
20	Noarlunga	709,710	Quarry Industries	Aggregate - quartzite
21	Willunga	65,66	Blue Metal Products	Aggregate - dolomite
22	"	56,57	Highways Department	Aggregate - dolomite?
23	Macclesfield	2948	R.W. & L.M. Campbell - closed	Aggregate - quartzite
24	Willunga	149	Christies Sand	Sand
25	"	139	International Sand	"
26	"	366	Alberts Sand	"
27	"	MS 1294	A.B.M. Noarlunga Sand	"
28	Kanmantoo	5328	Mt. Barker Quarries	Aggregate - quartzite
29	Onkaparinga	107	Highways Department -for freeway	Aggregate
30	Willunga	350	?	Filling sand
31	"	579	?	" "
32	"	26, 495	?	" "



SCALE IN METRES

0 1 2 3 4 5 6 7 8 9 10

SCALE IN MILES

0 1 2 3 4 5 6

LEGEND

- Q Q — Alluvial clays and sands of the Adelaide Plains. Red sand dunes
- Shallow alluvial deposits of drainage channels
- T — Principally sand clay of Tertiary age with veneer of younger formations in part
- K — Schists, micaceous quartzite in part kaolinised
- Quartzite, sandstone
- Dolomite, limestone
- Argillaceous rocks in part weathered to red and white clay shale metamorphosed in eastern areas
- Ec — Metasediments in part weathered to clay. May include some anatectic rocks of earlier events in part kaolinised

Boundary of Metropolitan Planning Area

Boundary of Hills Face Zone

G31 — Quarry and index number
A - Aggregate
C - Clay
S - Sand

Index number refers to report appendix

OFFICE COMPILATION SUBJECT TO FIELD CHECK

Geology from published 1:63,360 Gawler Geological Sheet

DEPARTMENT OF MINES — SOUTH AUSTRALIA

METROPOLITAN CONSTRUCTION MATERIALS SURVEY
GENERALISED GEOLOGICAL MAP OF POTENTIALLY PRODUCTIVE FORMATIONS
GAWLER

MINERAL RESOURCES SECTION	GEOLOGIST	Drn. MNH	SCALE: 1:63,360
		Trd. MES	72-482 BH
Director of Mines	SEN. GEOLOGIST	Chd	
		Encl.	DATE: 3rd August 1972

SALISBURY
PORT ADELAIDE
ENFIELD
WOODVILLE
PROSPECT
GRANGE
PAYNEHAM
NORWOOD
ADELAIDE
UNLEY
MITCHAM
GLENELG
MODBURY
CAMPBELLTOWN
NORTON SUMMIT
SUMMERTOWN
URAIDLA
MT LOFTY
CRAFERS
BELAIR
UNGLEWOOD
PARACOMBE
KERSBROOK
FORRESTON
BIRDWOOD
MOUNT TORRENS
SPRINGBANK
LENSWOOD
WOODSIDE
OAKBANK
BALHANNAH
ZONE OF DOLERITES
Torrens River

34°45'
35°00'
138°30'
138°45'

SCALE IN METRES
SCALE IN MILES

LEGEND

- Q — Sand, clay and associated sediments of the Adelaide Plains
- Alluvium of drainage channels
- T — Sand, clay with laterite capping in part
- K — Schist, micaceous quartzite in part kaolinised
- Major quartzite bands
- Quartzite, sandstone
- Dolomite, limestone
- Argillaceous rocks in part weathered to red white shale
- Ec — Metasediments
- Cretaceous granite and pegmatite

Boundary of Metropolitan Planning Area

Boundary of Hills Face Zone

43 — Quarry and index number
A - Aggregate
C - Clay
S - Sand

Index number refers to report appendix

OFFICE COMPILATION SUBJECT TO FIELD CHECK
Geology from published 1:63,360 Adelaide Geological Sheet

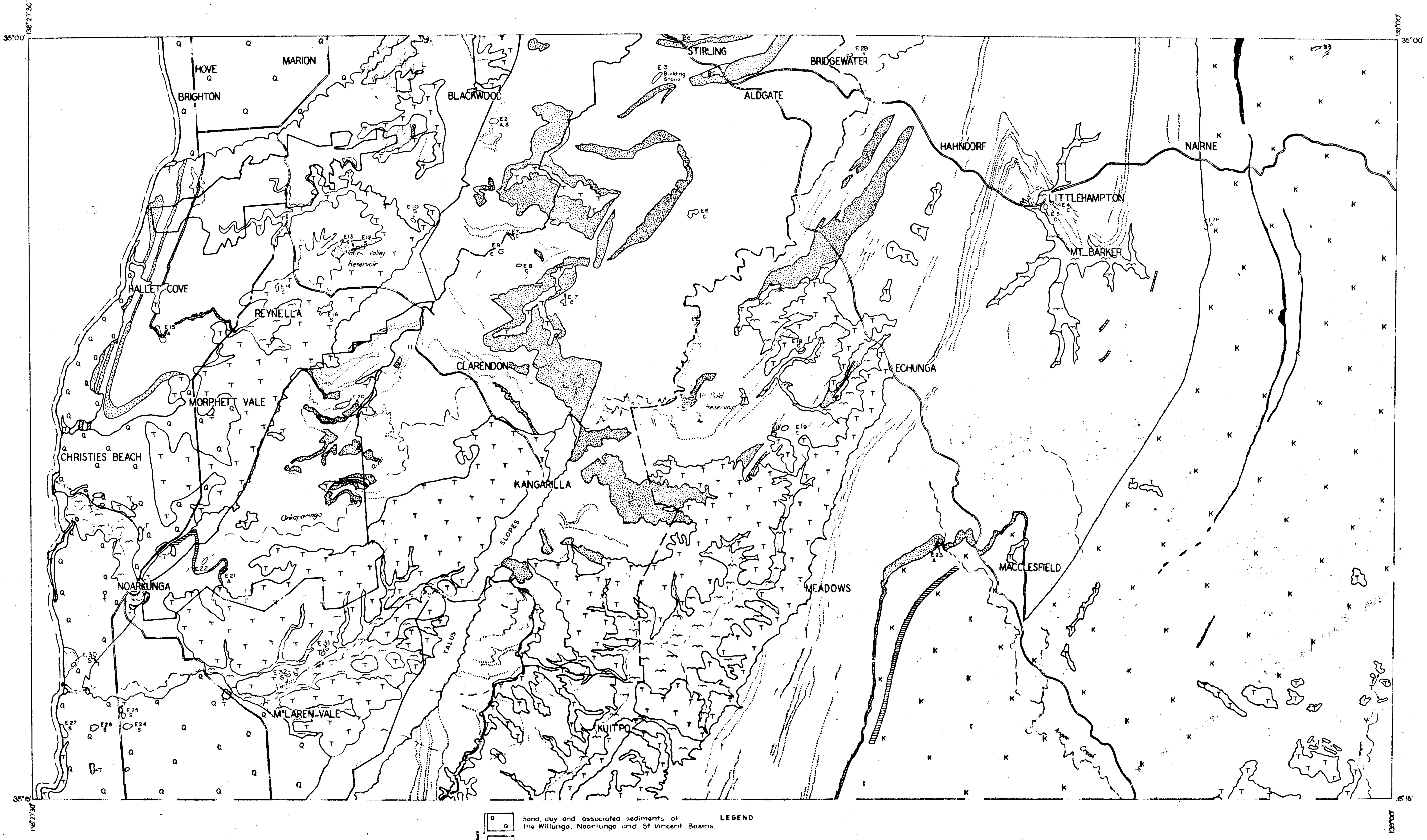
DEPARTMENT OF MINES — SOUTH AUSTRALIA

METROPOLITAN CONSTRUCTION MATERIALS SURVEY

GENERALISED GEOLOGICAL MAP OF POTENTIALLY PRODUCTIVE FORMATIONS

ADELAIDE

MINERAL RESOURCES SECTION	GEOLOGIST	Drn.	SCALE: 1:63,360
		Trd.	72-483 GH
Director of Mines	SEN. GEOLOGIST	Chd.	
		Encl.	DATE:



LEGEND

CAINOZOIC – RECENT	Q	Sand, clay and associated sediments of the Willunga, Noarlunga and St Vincent Basins.
	~	Alluvium of drainage channels
TERTIARY	T	Sand, clay with laterite capping in part
PALAEOZOIC – KANMANTOO GROUP	K	Phillite, schist, micaceous quartzite.
		Nairne Pyrite Schist
		Macclesfield Marble
		Quartzite, sandstone
UPPER PROTEROZOIC		Sandstone, quartzite
		Limestone, dolomite
		Argillaceous rocks in part weathered to brown, white shale
LOWER PROTEROZOIC	Bc	Schist, gneiss

Boundary of Metropolitan Planning Area

Boundary of Hills Face Zone.

E31 Quarry and index number

A - Aggregate

C - Clay

S - Sand

Index numbers refer to report appendix

SCALE IN METRES

1 0 1 2 3 4 5 6 7 8 9 10

1 0 1 2 3 4 5 6

SCALE IN MILES

OFFICE COMPILATION SUBJECT TO FIELD CHECK

Geology from published 1:63,360 Echunga Geological Sheet

DEPARTMENT OF MINES – SOUTH AUSTRALIA

METROPOLITAN CONSTRUCTION MATERIALS SURVEY

GENERALISED GEOLOGICAL MAP OF POTENTIALLY PRODUCTIVE FORMATIONS

ECHUNGA

MINERAL RESOURCES SECTION	GEOLOGIST	Drn. M.N.H.	SCALE: 1:63 360
		Td. M.J.S.	72-484 BH
		Ckd.	
	SEN GEOLOGIST	Exd.	DATE: 3rd August 1972

35°15'
138°20'
138°50'
35°15'

ALDINGA
WILLUNGA
Slate Quarry
Roadmetal Quarry
SELLICK HILL
MT. COMPASS
Myponga River
MYPONGA
Hindmarsh River
CURRENCY CREEK
Goolwa or Lower Murray River
GOOLWA

35°30'
138°20'
138°50'
35°30'

LEGEND

- Quaternary sediments including clays over Tertiary sequence in Willunga Basin
- Quaternary, alluvial, aeolian and terrestrial deposits. Permian glacial and Fluvioglacial deposits.
- Laterite surface, iron coated pebbles and pisolites.
- Undifferentiated sands and clays, in part iron cemented
- Greywacke phyllite, arkosic quartzite. Marble
- Shale. Limestone and dolomite
- Shale, friable sandstone arkose. Quartzite and sandstone. Limestone
- Schists, gneisses and quartzite

Boundary of Metropolitan Planning Area

Boundary of Hills Face Zone

SCALE IN METRES
0 1 2 3 4 5 6 7 8 9 10
SCALE IN MILES
0 1 2 3 4 5 6

OFFICE COMPILATION SUBJECT TO FIELD CHECK
Geology from published 1:63,360 Yankalilla-Milang Geological Sheet

DEPARTMENT OF MINES — SOUTH AUSTRALIA

METROPOLITAN CONSTRUCTION MATERIALS SURVEY
GENERALISED GEOLOGICAL MAP OF POTENTIALLY PRODUCTIVE FORMATIONS
YANKALILLA — MILANG

MINERAL RESOURCES SECTION	GEOLOGIST	Drn. M.N.H.	SCALE: 1:63,360
		Tcd. M.A.S.	72-485 GH 1 1
Director of Mines	SEN-GEOLOGIST	Ckd.	
		Exd.	DATE: 8TH AUGUST 1972