DEPARTMENT OF
MINERALS AND ENERGY

# BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record 1975/6

# PRELIMINARY GEOLOGICAL INVESTIGATION OF SOUTH QUEANBEYAN URBAN DEVELOPMENT AREA, NSW



by

J.P. Ceplecha

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## SUMMARY

A preliminary geological and soils investigation of the south Queanbeyan area was carried out to determine any design constraints on urban development.

The geological structures are complex, and a wide range of rock types is present: sandstone and siltstone are common centrally, with clastic sediments, limestone, volcanics, and adamellite to the east of Cooma Road, and volcanics and tuff with some intrusive rocks to the southwest of the area. Soils range from thin skeletal soils on steep slopes to thick residual soils on gentle slopes; partly consolidated talus deposits are common at the foot of slopes, and in the lower valley transported soils consisting of dense clay and silty clay may range in thickness to 9 m. Some of the transported soils are saturated and constitute a drainage problem, but elsewhere groundwater is present in bores in fractured volcanic rocks and in lesser amounts in sandstone and siltstone. Design constraints for urban planning are associated with -

(1) hard rock outcrop near the surface that is likely to require excavation with explosives;

(2) steep slopes in the southwest that may be too costly to develop;

(3) talus slopes that have poor foundation and stability characteristics;

(4) saturated soils that require drainage; and

(5) the characteristics of some streams that make them liable to flash flooding.

The steep slopes and flash-flooding areas should generally be avoided; limitations elsewhere are related to soil water drainage of the talus deposits and groundwater drainage of the transported soils south of Mt Jerrabomberra. The former will provide stability problems; the latter could provide foundation problems if drainage is not effective.

## INTRODUCTION

A preliminary geological investigation of the area south of Queanbeyan with regard to its suitability for urban development was conducted early in 1974 by the Bureau of Mineral Resources on behalf of the Queanbeyan City Council.

The investigation was concerned with rock and soil types, slope stability, and hydrogeology; a detailed study was made of the volcanic rocks but less detailed work on the sedimentary rocks.

The topography is generally hilly in the east, south and southwest, with a prominent hill, Mt Jerrabomberra, in the northwest. Undulating slopes occur in the central, western, and southwestern parts of the investigation area.

The vegetation comprises closed woodland over much of the hilly terrain grading into open to sparse woodland on the undulating surfaces. Part of the central northern area has been reforested by pine trees. On the alluvial flats fodder crops (including alfalfa) are grown.

The terms eastern and western section refer to the catchment areas (Pl. 3) of the Queanbeyan River and Jerrabomberra Creek respectively; the divide extends to the south from the old Jerrabomberra brick shale quarry (Pl. 4).

## GEOLOGY

The bedrock geology of the area is complex and has been described by several authors (see REFERENCES). A sequence of folded and faulted sedimentary and igneous rocks ranges in age from Middle Ordovician to Devonian. Alluvium is present in the valley of Jerrabomberra Creek.

Four major faults divide the area into four geological domains (Pl. 1) as follows:

(a) Southwest of the Deakin Fault. A sequence of shale and sandstone is overlain by pink, purple, and grey rhyodacite and dacite tuffs and flows of the Deakin and Colinton Volcanics; the Deakin Volcanics are intruded by the Mugga Mugga and Painter Porphyries.

(b) The northwest wedge between the Deakin and Sullivans Faults. The wedge consists mainly of sandstone and calcareous shale that are lithologically similar to sediments of the Canberra Group. A smaller area within the wedge is bounded by faults and consists of interbedded coarse quartzose sandstone and siltstone.

(c) Between Sullivans Fault and the Cooma Road. This area contains Mt Jerrabomberra which consists of coarse quartzose sandstone with lesser amounts of interbedded siltstone. The remainder of the area consists of thinly interbedded sandstone and siltstone with major interbeds of chert and grey siliceous graptolitic slate (Acton Shale).

(d) East of the Cooma Road. Close to the Cooma Road lies a thrust fault zone (Stauffer & Rickard, 1966) that marks the contact between the Ordovician sedimentary rocks and the Barrack Creek Adamellite. To the east and north of the adamellite, the Colinton Volcanics crop out extensively and contain a marble-slate marker unit. The Queanbeyan Fault to the east separates the Colinton Volcanics from older sediments consisting of quartz greywacke and siltstone of Ordovician Age.

## SOILS

The soils (Pl. 2) are broadly classified into those developed in situ (residual) and those which are transported (alluvial or colluvial).

In the eastern sector, shallow residual soils are widespread, but there are some transported soils in gullies and valleys. Skeletal soils are developed on the marble-slate marker unit of the Colinton Volcanics near the Queanbeyan River.

The western sector comprises skeletal and residual soils developed on the volcanic rocks with skeletal and colluvial soils on the sedimentary rocks (e.g. near Mt Jerrabomberra).

The talus material consists of rock fragments derived from the sedimentary rocks upslope. The poorly consolidated talus material is subject to soil creep on the slopes of Mt Jerrabomberra.

Streams in the western sector (Pl. 3) have deposited alluvial material in the lower parts of the valleys to depths of 7 m.

Isolated pockets of red aeolian silty and sandy clays are present on the lower western slopes of Mt Jerrabomberra, and to the southwest along the A.C.T. border.

Aeolian deposits similar to silty and sandy clay possibly underlie more recent alluvial and slopewash material in the northwest of the investigation area. This has been observed along parts of Jerrabomberra Creek near Jerrabomberra homestead where an orange silty sand underlies dark brown alluvium at a depth of about 15 cm.

## DRAINAGE

The area is drained by tributaries of the Queanbeyan River to the east (Pl. 3) and by tributaries of Jerrabomberra Creek to the west. The divide between the two catchments is approximately north-south through the middle of the mapped area.

Problems of soil drainage for urban development are confined to areas of alluvial and slopewash material and to low-lying areas with low permeability clays that tend to confine aquifers in the soil profile and so restrict subsurface drainage (about 1.2 km south-southwest of Mt Jerrabomberra).

At least one of the ephemeral springs downstream from the small pentagonal pine plantation is related to a confined aquifer in slopewash which is intersected by a deep gully. Two of the other springs (one near the Tharwa Road and one upstream from the pentagonal pine plantation) may possibly be related to the underlying geological structure (e.g. shear or fault zones, or jointing).

## GROUNDWATER

The availability of groundwater from bores is expected to range from fair in the fractured and jointed volcanic and intrusive rocks, to fair to poor in the sedimentary rocks generally, but would be poor in the dominantly siltstone and shale beds.

A number of successful bores are located on the property 'Poplars' (1.2 km southwest of Mt Jerrabomberra). Other bore sites are found north of the rifle range; they are located either close to the thrust zone or near the contact between Barrack creek Adamellite and Colinton Volcanics. In the latter case fractured volcanic rock constitutes the aquifer.

## DESIGN CONSTRAINTS

Design constraints of a geological nature are shown in Plate 4.

### Ease of Excavation

(a) The most favourable areas for excavation in terms of soil depths, soil consolidation, drainage, and relief are as follows:

(1) The area east from Mt Jerrabomberra to the Queanbeyan River, excluding those areas of skeletal soils and unstable slopes.

(2) The area east of the Queanbeyan River excluding these areas of greater local relief and unstable slopes that are more common than in (1) above.

(3) The valley south of Mt Jerrabomberra where low relief gives greater slope stability; however, drainage and foundation problems in some parts of this area are associated with the heavy clay soils.

(4) The area west of Mt Jerrabomberra, although not unsuited for development may have problems of stability and drainage in the talus material on the slopes, and there is a potential drainage problem in the area to the north of Casamaria homestead.

(b) Less suitable areas are those of skeletal soils and rock outcrop where blasting may be necessary for excavation purposes. The bedrock beneath skeletal soils is generally completely weathered to 0.5 m depth and highly weathered to 3 m depth. The depth of weathering depends on the nature of the bedrock; in cleaved sedimentary rocks highly weathered material may exceed 3 m depth but it is unlikely that the rock is rippable at or beyond 3 m depth; volcanic rocks are generally rippable to less than 3 m depth beneath skeletal soils. Such areas are listed below:

(1) Areas adjacent to the Queanbeyan River,

(2) The area south of the rifle range,

(3) Mount Jerrabomberra, and

(4) East of Jerrabomberra homestead (road base quarry ripped 2-3 m only).

(c) Residual soils in the south-southeast of the western sector show favourable characteristics for excavation, e.g. vertically cleaved crystal tuffs of Colinton Volcanics are highly weathered and most likely rippable to 3-4 m depth. The residual soils are adequately drained and slopes are stable with no evidence of creep, but the higher levels and sharp relief provide many problems for development of the area.

Flooding

Flooding may be experienced in the tributary valley east of the Queanbeyan River and in the small valley which drains north from the rifle range. Both valleys have a constriction in the drainage channel where they enter the Queanbeyan River, which may impede runoff and induce flash flooding.

Flooding could occur over the alluvial flats of Jerrabomberra Creek.

Sheet flooding could occur in the northwest corner of the area near Casamaria homestead and in the area south of Mt Jerrabomberra; this would not be such a problem as it has broad gentle slopes.

Slope Stability

Problems of stability in excavations will be encountered in the broad apron of colluvial soils that surrounds Mt Jerrabomberra and that ranges in thickness from 2 to 5 m. The soils have poor drainage characteristics and show evidence of slow downslope creep.

Similar problems may be encountered in excavations in the alluvial areas where saturated clay soils exhibit poor drainage characteristics and have low cohesion.

## CONSTRUCTION MATERIALS

Locations of possible sources of construction materials are shown on Plate 4.

Cleaved purple rhyodacitic tuff has been quarried 0.6 km southeast of Jerrabomberra homestead. Cleaved Colinton Volcanics 1.3 km southwest Jerrabomberra homestead could be used as a plastic gravel. Another potential plastic gravel source is located 0.6 km southwest of the Tharwa Road railway crossing. The former Queanbeyan brickshale quarry lies about 1 km northeast of Mt Jerrabomberra, and some of the sandstone was used as ornamental stone.

Non-plastic gravels from the adamellite were obtained from the White Rocks quarry adjacent to the Cooma Road on the southern boundary of the investigation area. A larger non-plastic gravel quarry, now disused, is located about 1 km to the north of White Rocks quarry. Marble has been quarried from deposits near the Queanbeyan River, and river sand is currently being dredged from the Queanbeyan River.

## CONCLUSIONS

1. The areas most suitable for urban development are those where colluvial and residual soils exceed 0.5 m in thickness on gentle slopes. These areas are extensive to the west of the Queanbeyan River, to the east of Mt Jerrabomberra, and to the south and west of Mt Jerrabomberra.

2. Other suitable areas are those where alluvium and slopewash are consolidated and adequately drained, to the south and southwest of Mt Jerrabomberra.

3. Less suitable areas are those where skeletal soils are less than 0.5 m thick, so that excavation could require blasting; where colluvial soils (talus) around Mt Jerrabomberra comprise what could constitute

unstable slopes in a saturated state, and the saturated alluvial zone south of Mt Jerrabomberra which has a soil drainage problem that would require special attention before it could be developed.

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## APPENDIX 1

### DEFINITION OF SEMI-QUANTITATIVE DESCRIPTIVE TERMS

**Bedding**

| | | |
|---|---|---|
| Laminated | - | Less than 10 mm thick |
| Thinly bedded | - | 10 mm to 100 mm thick |
| Thickly bedded | - | More than 100 mm thick |

**Grain Size**

| | | |
|---|---|---|
| Coarse-grained | - | 1 mm to 4 mm in diameter |
| Medium-grained | - | $\frac{1}{4}$ mm to 1 mm in diameter |
| Fine-grained | - | Less than $\frac{1}{4}$ mm in diameter |

**Hardness of Rock**

| | | |
|---|---|---|
| Hard to very hard | - | Impossible to scratch with a knife blade |
| Moderately hard | - | Shallow scratches with a knife blade |
| Soft | - | Deep scratches with a knife blade |

**Joint Spacing**

| | | |
|---|---|---|
| Closely spaced | - | Joints spaced less than 15 cm apart |
| Moderately spaced | - | Joints spaced between 15 cm and 90 cm apart |
| Widely spaced | - | Joints spaced more than 90 cm apart |

**Percussive Strength of Rock**

| | | |
|---|---|---|
| Strong to very strong | - | Cannot be broken by repeated blows with a hammer |
| Moderately strong | - | Rock broken by 3 or 4 blows |
| Weak | - | Rock broken by 1 blow |

**Weathering of Rock**

| | | |
|---|---|---|
| Fresh | - | No discolouration or less in strength |
| Fresh Stained | - | Limonitic staining along fractures; rock otherwise fresh and shows no loss of strength |
| Slightly weathered | - | Rock is slightly discoloured, but not noticeably lower in strength than the fresh rock |
| Moderately weathered | - | Rock is discoloured and noticeably weakened; N-Size drill core generally cannot be broken by hand across the rock fabric. |

Weathering of Rock (cont'd)

| | | |
|---|---|---|
| Highly weathered | - | Rock is discoloured and weakened; N-size drill core can generally be broken by hand across the rock fabric |
| Completely weathered | - | Rock is decomposed to a soil, but the original rock fabric is mostly preserved. |

# QUEANBEYAN URBAN DEVELOPMENT INVESTIGATION N.S.W., 1974

## GEOLOGY

**(Based on photo-interpretation and field work. The units are arranged in an approximate stratigraphic column.)**

- QUATERNARY
  - *Alluvium*
- SILURIAN-DEVONIAN
  - Barrack Creek Adamellite — *Adamellite*
  - Mugga Mugga Porphyry — *Porphyritic dacite*
  - Pointer Porphyry — *Bluish-grey rhyodacite*
- UPPER SILURIAN
  - Deakin Volcanics
    - *Grey-green welded tuff, cream rhyolite tuff*
    - *Purple porphyritic rhyodacite, and tuffaceous shale and mudstone*
    - *Welded tuffs, feldspathic labile sandstone*
    - *Grey-green porphyritic dacite-tuff, and brown, welded dacite*
    - *Pink to pink-green rhyodacite (with epidote veinings)*
    - *Cleaved purple rhyodacitic tuff with ashstone lens*
    - *Blue-green porphyritic dacite*
    - *Grey-green porphyritic welded tuff*
- MIDDLE TO UPPER SILURIAN
  - Colinton Volcanics — *Cleaved welded tuffs with marble-slate marker units*
  - *Undifferentiated shale, sandstone*
  - *Red siliceous shale*
  - *Cleaved calcareous shale*
  - *Siliceous sandstone*
- LOWER SILURIAN — *Coarse quartzose sandstone*
- MIDDLE TO UPPER ORDOVICIAN
  - Pittman Formation — *Shale, sandstone, slaty shales*; *Chert*; *Highly cleaved shale in fold axes*
  - Acton Shale — *Shale*
- LOWER ORDOVICIAN — *Quartz, greywacke, siltstone*

*Gossan, ap (pyritic quartz)* — *Fault* — *Shear zone* — *Syncline* — *Pine plantation*

*Geological boundary* — *Fault, inferred* — *Anticline* — *Thrust*

N

BELCONNEN · CANBERRA · WODEN · QUEANBEYAN · TUGGERANONG

Federal Hwy · Barton Hwy · Monaro Hwy · Kings Hwy · Canberra Ave

0 5 10 15 km

*Built-up area* — *Area investigated*

*Highway* — *Secondary road* — *Railway* — *Territorial boundary*

| AMENDMENTS | | | | | |
|---|---|---|---|---|---|
| No. | DESCRIPTION | AUTHOR | DATE | CHECKED | DATE |
| A1 | | | | | |
| A2 | | | | | |
| A3 | | | | | |
| A4 | | | | | |
| A5 | | | | | |
| A6 | | | | | |

SCALE 0 200 400m

BASE MAP/SURVEY

GEOLOGY BY J.P. CEPLECHA

COMPILED AND CHECKED: J.P.C — PROJECT GEOLOGIST

CHECKED AND APPROVED — SENIOR GEOLOGIST

E.G. WILSON — SUPERVISING GEOLOGIST

COMMONWEALTH OF AUSTRALIA
**BUREAU OF MINERAL RESOURCES**
CANBERRA, A.C.T.

**PLATE 1**

TITLE: PRELIMINARY GEOLOGICAL MAP

PROJECT: QUEANBEYAN URBAN DEVELOPMENT AREA

| TO ACCOMPANY RECORD | DRAWN BY | DRAWING NUMBER |
|---|---|---|
| 1975/6 | M.McL | 155/A16/1239 |

(Based on 155/A16/1236)

# QUEANBEYAN URBAN DEVELOPMENT INVESTIGATION N.S.W., 1974

48000E 52000E 56000E 60000E 64000E 68000E 72000E 76000E

20000S

24000S

28000S

32000S

Casomaro

"Jerraboomberra"

JERRABOMBERRA HILL

Jerraboomberra 2568

JERRABOMBERRA CREEK

Poplars

WHITE ROCKS QUARRY

RIFLE RANGE

TRANSFIELD ROAD

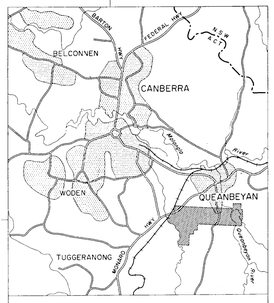
## SOILS

(Based on photo-interpretation and field work. The units are arranged in an approximate stratigraphic column)

RESIDUAL
- Skeletal soils (<0·5m thick)
- Differentiated residual soil

TRANSPORTED
- Colluvium (includes talus and soil that exhibit creep structures - unsuitable for foundations)
- Slopewash or hillwash (>2·0m thick) that is generally stable
- Alluvium (<7m thick)
- Reddish aeolian clayey silts and sands
- Hillwash overlying residual soil. (Hillwash generally 0·5 - 2·0m thick)

Pine plantation




(Based on 155/A16/1236)

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| No. | DESCRIPTION | AUTHOR | DATE | CHECKED | DATE |
| A1 | | | | | |
| A2 | | | | | |
| A3 | | | | | |
| A4 | | | | | |
| A5 | | | | | |
| A6 | | | | | |

SCALE 0 200 400m

BASE MAP/SURVEY

GEOLOGY BY J.P. CEPLECHA

COMPILED AND CHECKED J.P.C. PROJECT GEOLOGIST

CHECKED AND APPROVED SENIOR GEOLOGIST

SUPERVISING GEOLOGIST

**PLATE 2**

COMMONWEALTH OF AUSTRALIA
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TITLE: PRELIMINARY SOILS MAP

PROJECT: QUEANBEYAN URBAN DEVELOPMENT AREA

| TO ACCOMPANY RECORD | DRAWN BY | DRAWING NUMBER |
|---|---|---|
| 1975/6 | M.McL. | 155/A16/1241 |

# QUEANBEYAN URBAN DEVELOPMENT INVESTIGATION N.S.W., 1974

48000E 52000E 56000E 60000E 64000E 68000E 72000E 76000E

20000S 24000S 28000S 32000S

"Jerrabomberra" Casomaro Poplars Jerrabomberra 2568 WHITE ROCKS QUARRY

JERRABOMBERRA CREEK · THARWA ROAD · JERRABOMBERRA HILL ROAD · TIPLE RANGE · COOMA ROAD · Queanbeyan River

N

BELCONNEN · CANBERRA · WODEN · QUEANBEYAN · TUGGERANONG · FEDERAL HWY · BARTON HWY · MONARO HWY · N.S.W. A.C.T. · Molonglo River

0 5 10 15 Km

Built-up area · Area investigated · Highway · Secondary road · Railway · Territorial boundary

## DRAINAGE

- Ephemeral soak or spring
- Marsh area or potential drainage problem area
- Water bore
- Windmill and/or bore
- Minor watershed
- Watershed Queanbeyan River
- Ephemeral stream
- Perennial stream
- Pine plantation

**PLATE 3**

| AMENDMENTS | | | | | |
|---|---|---|---|---|---|
| No. | DESCRIPTION | AUTHOR | DATE | CHECKED | DATE |
| A1 | | | | | |
| A2 | | | | | |
| A3 | | | | | |
| A4 | | | | | |
| A5 | | | | | |
| A6 | | | | | |

SCALE 0 200 400m

BASE MAP/SURVEY

GEOLOGY BY J.P. CEPLECHA

COMPILED AND CHECKED J.P.C PROJECT GEOLOGIST

CHECKED AND APPROVED SENIOR GEOLOGIST

SUPERVISING GEOLOGIST

COMMONWEALTH OF AUSTRALIA
**BUREAU OF MINERAL RESOURCES**
CANBERRA, A.C.T.

TITLE: PRELIMINARY DRAINAGE MAP

PROJECT: QUEANBEYAN URBAN DEVELOPMENT AREA

TO ACCOMPANY RECORD 1975/6 · DRAWN BY M.McL · DRAWING NUMBER 155/A16/1242

(Based on 155/A16/1236)

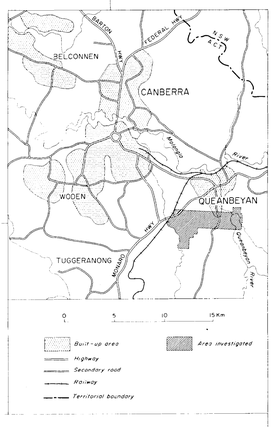
# QUEANBEYAN URBAN DEVELOPMENT INVESTIGATION N.S.W., 1974

48000E 52000E 56000E 60000E 64000E 68000E 72000E 76000E

20000S 24000S 28000S 32000S

Casamara
Poplars
Jerrabomberra
Jerrabomberra @ 2569
HILL ROAD
TARAGA ROAD
JERRABOMBERRA CREEK
WHITE ROCKS QUARRY
COOMA ROAD
RIFLE RANGE
Queanbeyan River
"Jerrabomberra"

N




## DESIGN CONSTRAINTS

- V — *Mainly saturated alluvium (>2·0m thick) thick is poorly drained and has low bearing strength*
- *Alluvium and slopewash generally 2·0 to 9·0m thick, of low to moderate bearing strength; generally adequately drained*
- *Colluvium and soil 0·5-3·0m thick of low to moderate bearing strength and adequately drained*
- *Skeletal soils (generally 0·5m thick) and colluvium overlying shale, sandstone and volcanic rocks. May require explosives for excavation of rock for services. Slopes may be unstable in places.*
- *Semi-consolidated talus material; slopes exhibit soil creep. Slope stability a problem in excavations; bearing strength probably adequate for light structures*

- *Ephemeral spring or soak*
- *Former quarry site*
- *Pine plantation*

**PLATE 4**

| AMENDMENTS | | | | | |
|---|---|---|---|---|---|
| No. | DESCRIPTION | AUTHOR | DATE | CHECKED | DATE |
| A1 | | | | | |
| A2 | | | | | |
| A3 | | | | | |
| A4 | | | | | |
| A5 | | | | | |
| A6 | | | | | |

SCALE 0 200 400m

BASE MAP/SURVEY

GEOLOGY BY: J.P. CEPLECHA

COMPILED AND CHECKED: J.P.C — PROJECT GEOLOGIST

CHECKED AND APPROVED — SENIOR GEOLOGIST

SUPERVISING GEOLOGIST

COMMONWEALTH OF AUSTRALIA
**BUREAU OF MINERAL RESOURCES**
CANBERRA, A.C.T.

TITLE: PRELIMINARY DESIGN CONSTRAINTS MAP

PROJECT: QUEANBEYAN URBAN DEVELOPMENT AREA

| TO ACCOMPANY RECORD | DRAWN BY | DRAWING NUMBER |
|---|---|---|
| 1975/6 | M.McL | 155/A16/1240 |

(Based on 155/A16/1236)