ENGINEERING GEOLOGY OF MELTON - SUMMARY

P G DAHLHAUS

UNPUBLISHED REPORT 1986/7

ABSTRACT

An engineering geological mapping program has been conducted to provide essential geological information for use by planners and engineers working in the Melton Development Area, Victoria.

A review of past and current examples of thematic mapping for land use purposes was initially conducted. A data base of over 800 sampled locations was collated from previous work, and supplemented by additional drilling and testing in areas where little was known of the geological materials. This information was compiled using available computer facilities and combined with traditional field mapping methods. A map folio presenting individual aspects of the engineering geology was produced.

Large areas of expansive soil have been identified and mapped, and an area affected by soil subsidence was examined in detail. Statistical methods (block kriging) have been used to determine the thickness of soil in the map area. Assesments of the suitability for urban development have been made.

Computer draughting was used to produce the maps, providing the ability for rapid future revision.

CONTENTS

LIST OF FIGURES

INTRODUCTION

The City of Melton is located on the Western Highway 39 km WNW of Melbourne and was chosen by the Victorian Government for satellite township development in 1973.

The Melton Engineering Geological Mapping Project commenced in March 1983, as part of an ongoing mapping scheme conducted by the Geological Survey of Victoria (GSV), now a branch of the Department of Industry, Technology and Resources (DITR). The project aims at the production of a map (or maps) depicting relevant geological features and properties in a useful manner for engineers and planners working in the Melton Development Area.

An engineering geological map is a thematic map which provides a generalized representation of all those components of a geological environment of significance in land-use planning, and in design, construction and maintenance as applied to civil engineering.

A 'state-of-the-art' review of mapping methods for land-use planning was conducted to examine the past and present progress in a broad context. In particular, medium-scale engineering and environmental mapping methods, and their map presentation formats, were examined.

A review of readily accessible data highlighted shortcomings in both the quality and quantity of data outside of the established City of Melton. Consequently, a drilling, sampling and testing program was conducted. Research of previous work and additional geological mapping supplemented the data analysis. The presentation of the study has been largely cartographic, with each component of the geology being a separate theme on a basic map.

Seven reports have been produced in the GSV Unpublished Report series:

Unpublished Report 1986/1
Engineering Geological Mapping - A Review

Unpublished Report 1986/2
Engineering Geology of Melton - The Melton Development Area

Unpublished Report 1986/3
Engineering Geology of Melton - Drilling, testing and mapping program

Unpublished Report 1986/4
Engineering Geology of Melton - Geology and geomorphology

Unpublished Report 1986/5
Engineering Geology of Melton - Engineering geology

Unpublished Report 1986/6
Engineering Geology of Melton - Map presentation of data

Unpublished Report 1986/7
Engineering Geology of Melton - Summary

SUMMARY

1 Review

Geology is intimately concerned with the environment: it includes the study of natural materials and natural processes and seeks to explain their interaction. Geological investigations concern the examination of both surface and subsurface phenomena and their development through time. With the historical viewpoint inherent in much of geological thought, and with experience in evaluating the Earth's capacity to provide water, mineral resources, waste disposal and building sites, the geologist is well placed to make a significant contribution towards the solution of problems concerning the physical environment.

Since traditional geological maps were first published they have portrayed the relationships and spatial occurrences of rock units grouped together by lithology and age. The major limitations in using these maps for planning and engineering purposes is their lack of information in the third dimension.

A growing public recognition of the deleterious effect that rapid population increases and the accompanying modern land usage has on natural systems, and the need to overcome such problems with a minimum of lasting damage, has led to the development of specialist maps for land use planning. Of these, engineering geological maps elucidate the geological conditions in three dimensions, so that engineers and planners can anticipate any development restrictions that the geology of an area may impose.

The objective of engineering geological mapping is to present geological information in a format which should be readily understood by planners, administrators, non-professionals, and engineers, many of whom are unfamiliar with geological concepts and lack a working knowledge of the subject.

An examination of published examples of engineering geological maps show no generally accepted selection of topics warranting specific selection, and no common format or scale. However, conformity is not necessary, since each environment imposes a different set of significant factors. Usual topics include engineering properties, slope stability, hydrogeology, and waste disposal. Some published maps attempt to overlay these elements and recognise areas where they are both suitable and problematic for various land uses. In other examples a much simplier presentation of map folios, in which each component of the engineering geological map is presented on a separate mapsheet, is used. The object of the simpler presentation is the production of preliminary geological advice, with established procedures for detailed follow-up studies and revision of individual mapsheets as more data is obtained. Computer data storage and drafting provide the most efficient available method of simple map production.

2 The Project

The engineering geological mapping project commenced in 1983 as part of an on-going scheme to provide engineering geological information for Melbourne's growth corridors.

Previous work for planning in the development area included small scale terrain mapping and medium scale land capability mapping. Very little was known of the underlying geological materials and their engineering properties.

A review of readily accessible data highlighted shortcomings in both the quantity of data outside of the established City of Melton, and the quality of the recorded information. To suppliment the existing data an extensive drilling, sampling and testing program was conducted.

The complete data set has then been collated, interpreted and presented in simple cartographic form, with each component of the geology being a separate theme on a basic map. The concept of such a map folio is to isolate and give equal treatment to the geological components of significance in engineering and planning. Each individual map may then be revised as appropriate data is acquired.

The level of confidence which can be attached to any of the maps reflects the sophistication and accuracy of the basic data. Because of gaps or omissions in the data set it is not possible to reliably present some aspects of the geology over the whole of the mapsheet area. This limitation provided by the lack of time and funds cannot be avoided. Each map is accompanied by a disclaimer which is intended to warn the user of these gaps.

The following maps make up the Melton engineering geological map folio:

* Location
* Documentation sites
* Surface geology and geomorphology
* Subsurface geology
* Soil depth
* Rockhead contours
* Standing water-table level
* Groundwater piezometric surface
* Sand and gravel potential
* Site classification
* Engineering geology units

3 Location Map

The location map (Fig. 1) is included in the Melton map folio to indicate the geographic location and boundaries of the designated Melton Development Area.

The City of Melton is located on the Western Highway 39 km. WNW of Melbourne and is situated in the parishes of Djerriwarrh, Kororoit and Pywheitjorrk. Existing residential areas are mostly situated on both sides of the Western Highway between Toolern Creek and Bulmans Road. Newer residential areas are being developed north of Centenary Avenue and in West Melton.

The chosen development area for Melton is bounded by Mt Cottrell Rd Minns Rd, Greigs Rd, Melton Reservoir and Djerriwarrh Creek.

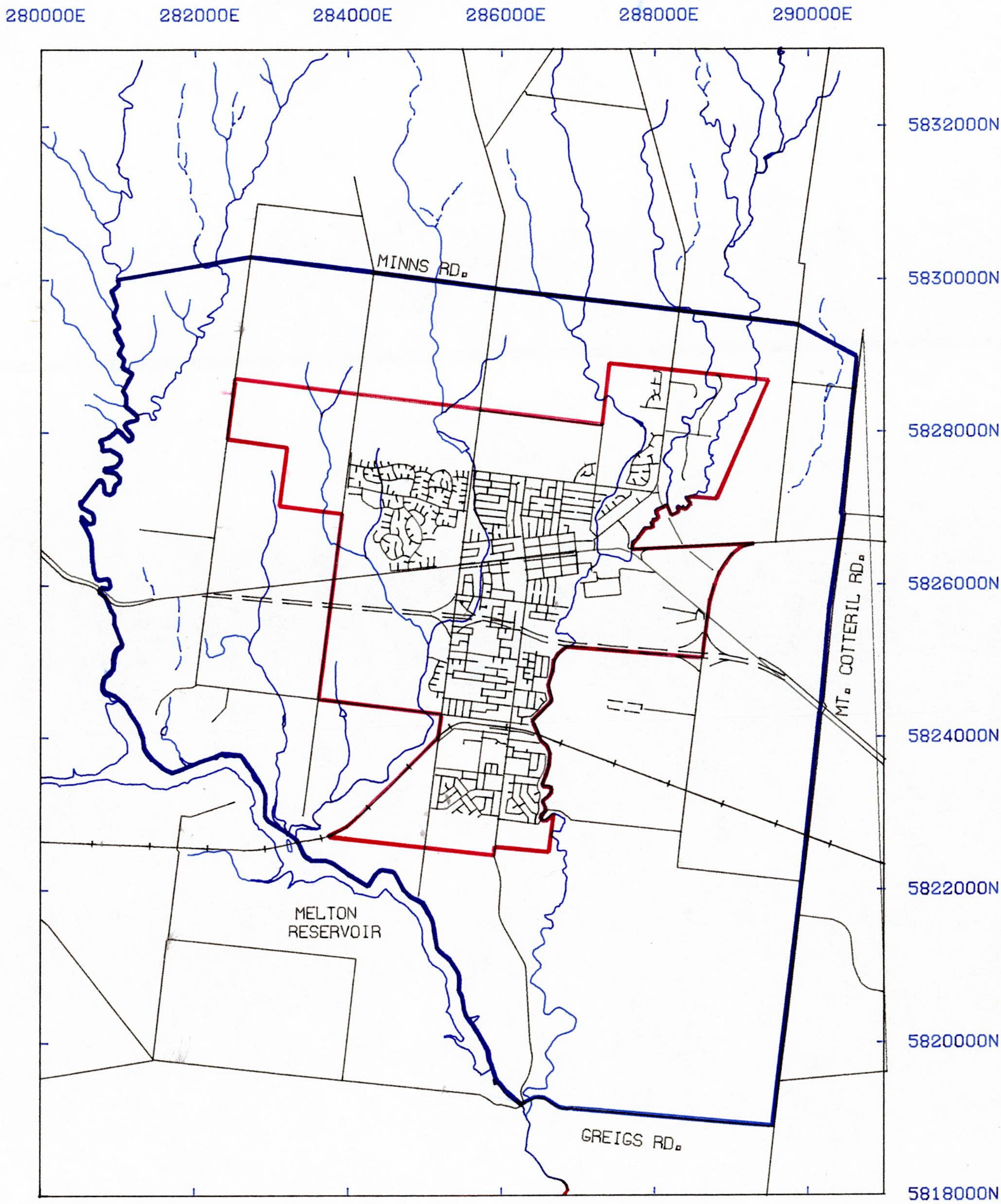
The map is presented at a scale of 1:75000.

4 Documentation Map

The documentation map (Fig. 2) can be viewed as a reliability diagram. It is produced at 1:50000 scale with point symbols of two millimetres (100m on the ground). The map intends to convey an overview of the data set, illustrating both density and distribution. Although the precise location of some sampled points is not known, as they have been scaled from other maps or plotted from location descriptions, all sample points would be correctly located within 100 metres.

Sampled points are either boreholes or test-pits. The data for any site may comprise geologist's, engineer's or driller's lithological logs; engineering soil and/or rock tests; and hydrogeological records. No attempt has been made to distinguish the quality of data or method of drilling. Although this would be desirable, for much of the data such detail is unknown. The purpose for which each site was sampled is shown.

All records of drilling or excavation carried out by the GSV are avalable to the public. For some of these sites samples such as soil and rock core are kept in the DITR core library and are available for inspection on application. Restrictions on the availability of data from other sources may apply, since it remains the confidential property of the owner.



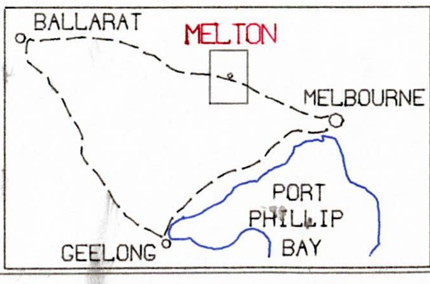
BOUNDARY OF PROPOSED MELTON TOWNSHIP PLANNING SCHEME

BOUNDARY OF LONG TERM URBAN AREA

G.N.

0 1500 3000metres

SCALE 1:75000

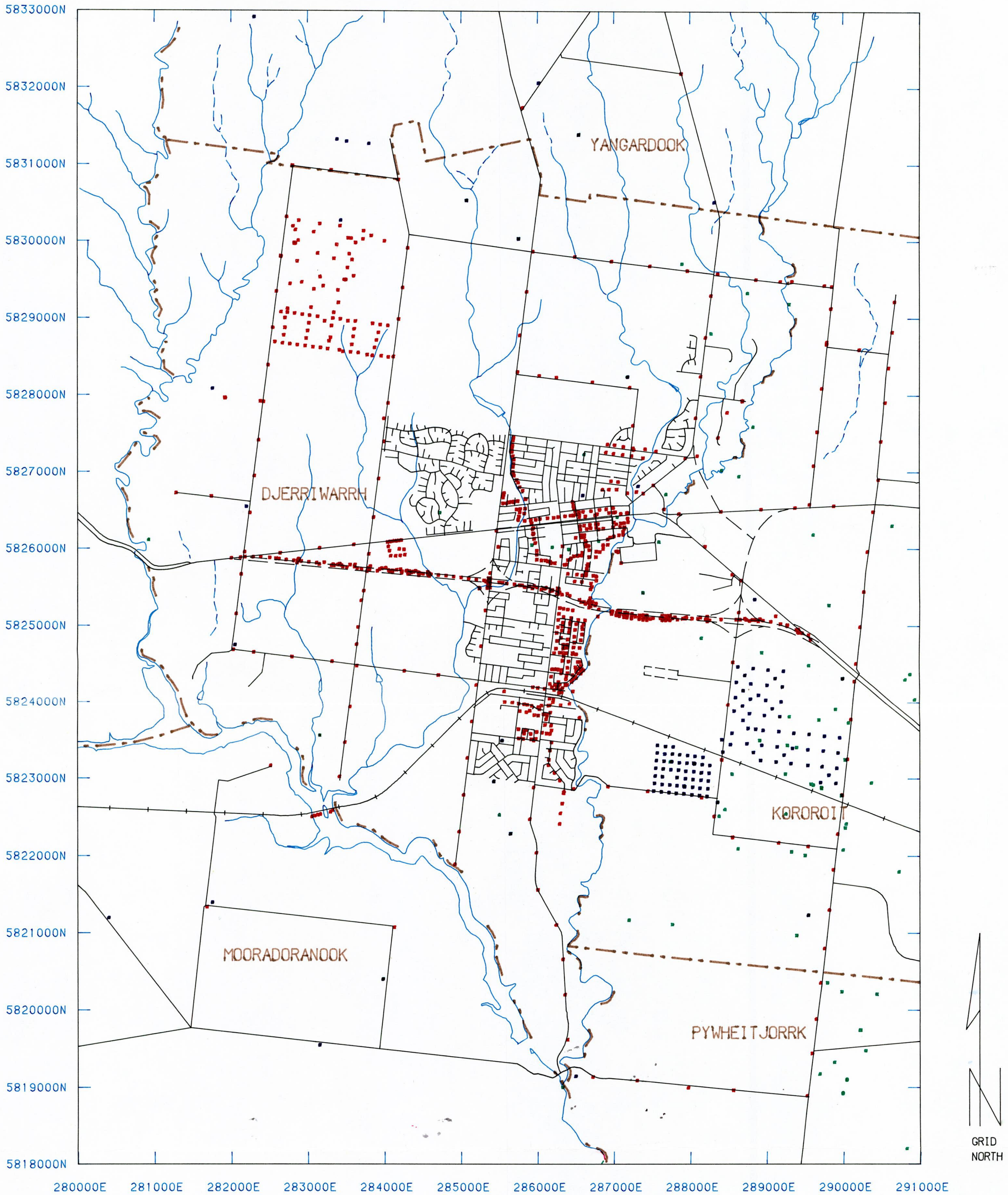


ENGINEERING GEOLOGICAL MAPPING
OF MELTON, VICTORIA.

Figure 1. MELTON DEVELOPMENT AREA

PROJ NO. GE 14 | DATE: 17-NOV-87

This map is to be used only for preliminary studies and is not intended as a substitute for on-site investigation.



0 2500 5000metres

SCALE 1:50000

INFORMATION COLLATED FROM:
Geological Survey of Victoria
Road Construction Authority *
Railway Construction Board *
State Electricity Commission *
Public Works Department *
Melton Sewage Authority *
Farley and Lewers Pty Ltd *
CRA Exploration Ltd *

* restricted information

LEGEND

• - MINERAL EXPLORATION BORE
• - GROUNDWATER BORE
• - ENGINEERING BORE OR TEST PIT
KOROROIT - Parish name

DEPARTMENT OF INDUSTRY TECHNOLOGY AND RESOURCES

GEOLOGICAL SURVEY OF VICTORIA

ENGINEERING GEOLOGICAL MAPPING OF MELTON, VICTORIA.

Figure 2.
DOCUMENTATION MAP

PROJ NO. GE 14	DATE: 17-NOV-87

Geological Survey of Victoria Unpublished Report 1986/7

5 Surface Geology and Geomorphology

5.1 Geology

The surface geology and geomorphology map depicts units of similar lithology and geological age. It has been assembled from previous work in the area, notably that by Condon (1948), Kenley (1958), Vandenberg (1972) and Roberts (1984), and the additional information gained through the engineering geological mapping project. It is presented at 1:50000 scale.

The basement rocks of the Melton Development Area are the Ordovician interbedded sandstones, greywacke and shales, which occur in outcrop along Djerriwarrh Creek and in road cuttings along the Western Highway. Along Djerriwarrh creek they have been delineated into the Lower Ordovician (Bendigonian), west of the Djerriwarrh Fault (which is located just outside the Development Area boundary) and the Upper Ordovician east of the fault, on the basis of fossil evidence (VandenBerg, 1974). The fault is regarded as a non-rejuvenated Palaeozoic (Devonian ?) fault, the position of which is estimated from from known graptolite fossil localities.

The majority of the Melton Development Area is covered by the basalt flows of the Newer Volcanics (Qvn). The basalt, and occasional tuff and scoria, belong to the younger or Werribee Plains Phase of the Newer Volcanic Suite in Victoria. The unit is composed of many separate flows of Pliocene age, some separated by considerable intervals of time. The last eruption centres from which the flows eminated are at Melton Park (NW), Wood Hill (NE) and Mt Cottrell (SE).

Predominant constituents of the basalt are olivine, plagioclase feldspar, clinopyroxine and opaque oxides, with rare alkali feldspar, apatite and glass (Carr, 1982). The basalt has weathered to a montmorillonite-rich clay soil, commonly containing floaters and carbonate horizons.

Expanses of alluvial deposits (Qrt) of Quaternary age overlie the basalts along Toolern Creek (north of the Western Freeway), to the west of the City Melton, and to the south at Exford. These deposits are derived from the fault scarps to the north and west of the Melton Development Area, both of which were active during the time of volcanism. The large expanse to the west of the City of Melton is regarded as an outwash deposit, and comprises a mix of alluvial gravel, sand and silt with the residual soils derived from the weathering of the basalt. The deposits along Toolern Creek and at Exford largely comprise alluvial gravels, sands and silts. Along the reservoir, three small alluvial deposits appear to be interbedded with the basalt and are thus assigned to the Tertiary, although they are indistinguisable from the Quaternary deposits.

5.2 Geomorphology

The geomorphic features illustrated on the map are the dominant volcanic features. The lava flows which are obvious on the ground as gentle rises with associated surface boulders ('floaters') represent the last of the volcanic activity in the area. In the south-eastern quadrant of the map area, several broad and very shallow depressions are also shown. These are attributed to still fluid lava being drained from beneath an early formed skin, at the time of volcanic activity.

6 Subsurface Geology.

The fence diagram illustrating the subsurface stratigraphy (Fig. 4) has been constructed from the limited deep drilling information available in the mapsheet area. It shows that the Ordovician basement generally falls away to the south-west, which may be either a basement warp or downfaulting which delineates the northern edge of the Ballan Graben.

Overlying the Ordovician sediments in the south of the map area are the sediments of the Werribee Formation, which are essentially composed of sands, sandy silts and clays, and occasional gravels. The sandy material is usually slightly cemented, very dense, and almost entirely composed of quartz. The Werribee Formation ranges in age from the Miocene to Palaeocene, and in this vicinity contains two members.

The Early Miocene Maddingley Coal Measures has been intersected in bores drilled for mineral exploration and the site investigation for the railway viaduct. The Measures are generally described as dark brown to black, moderately soft, moist, and often interbedded with sands, silts and clays. The coal seam is thickest in the southwest corner of the map area, and splits, thins and grades laterally to ligneous clay to the north and east.

Basalt up to 20 metres thick, which is interbedded with the Werribee Formation, has been also intersected in the deeper bores in the southern portion of the mapsheet area. These are part of the Tertiary Older Volcanics, and are thought to be the equivalent of the Kerr's Road Volcanics. The basalt occurs 20 metres above the coal seams and is described as varying from speckled brown, grey-brown and yellow brown, very finely vesicular weathered basalt to blue-grey, dense, fresh basalt.

Overlying the Werribee Formation are the basalt flows of the Newer Volcanic Suite. The basalt cover thins to the northeast of the area, with Djerriwarrh Creek forming the limit of its extent. The thickest intersection is 97 metres in bore Kororoit 15. Sections through the basalt indicate that many separate flows took place, some separated by considerable intervals of time. In some bores up to 3 metres of interbedded palaeosols and alluvial sediments occur.

This map is to be used only for preliminary studies and is not intended as a substitute for on-site investigation.

SCALE 1:50000

LEGEND

Ou - Ordovician sediments
interbedded sandstone, siltstone, greywacke.

Tpg - Tertiary alluvial deposits
sands, silts, clays, occasional gravel.

Qvn - Newer Volcanics
basalt, minor scoria.

Qrt - Quaternary alluvial deposits
sands, silts, clay, occasional gravels.

Qra - Recent alluvium

Inferred geological boundary

Boundary of basalt flow

Depression

DEPARTMENT OF INDUSTRY TECHNOLOGY AND RESOURCES

GEOLOGICAL SURVEY OF VICTORIA

ENGINEERING GEOLOGICAL MAPPING OF MELTON, VICTORIA.

Figure X.70

SURFACE GEOLOGY AND GEOMORPHOLOGY

PROJ NO. GE 14	DATE: 5-JAN-88

GOVERNMENT BORES

D1 DJERRIWARRH 1
D2 DJERRIWARRH 2
D3 DJERRIWARRH 3
D4 DJERRIWARRH 4
D7 DJERRIWARRH 7
D8 DJERRIWARRH 8
D9 DJERRIWARRH 9
D10 DJERRIWARRH 10
K14 KORORO1T 14
K15 KORORO1T 15
K16 KORORO1T 16
M2 MOORADORANOOK 2
Y3 YANGARDOOK 3
Y4 YANGARDOOK 4
Y5 YANGARDOOK 5
Y6 YANGARDOOK 5
Y7 YANGARDOOK 7
Y8 YANGARDOOK 8

C.R.A. EXPLORATION BORES

MB001
MB017
MB023
MB024
MB029
MB030
MB031

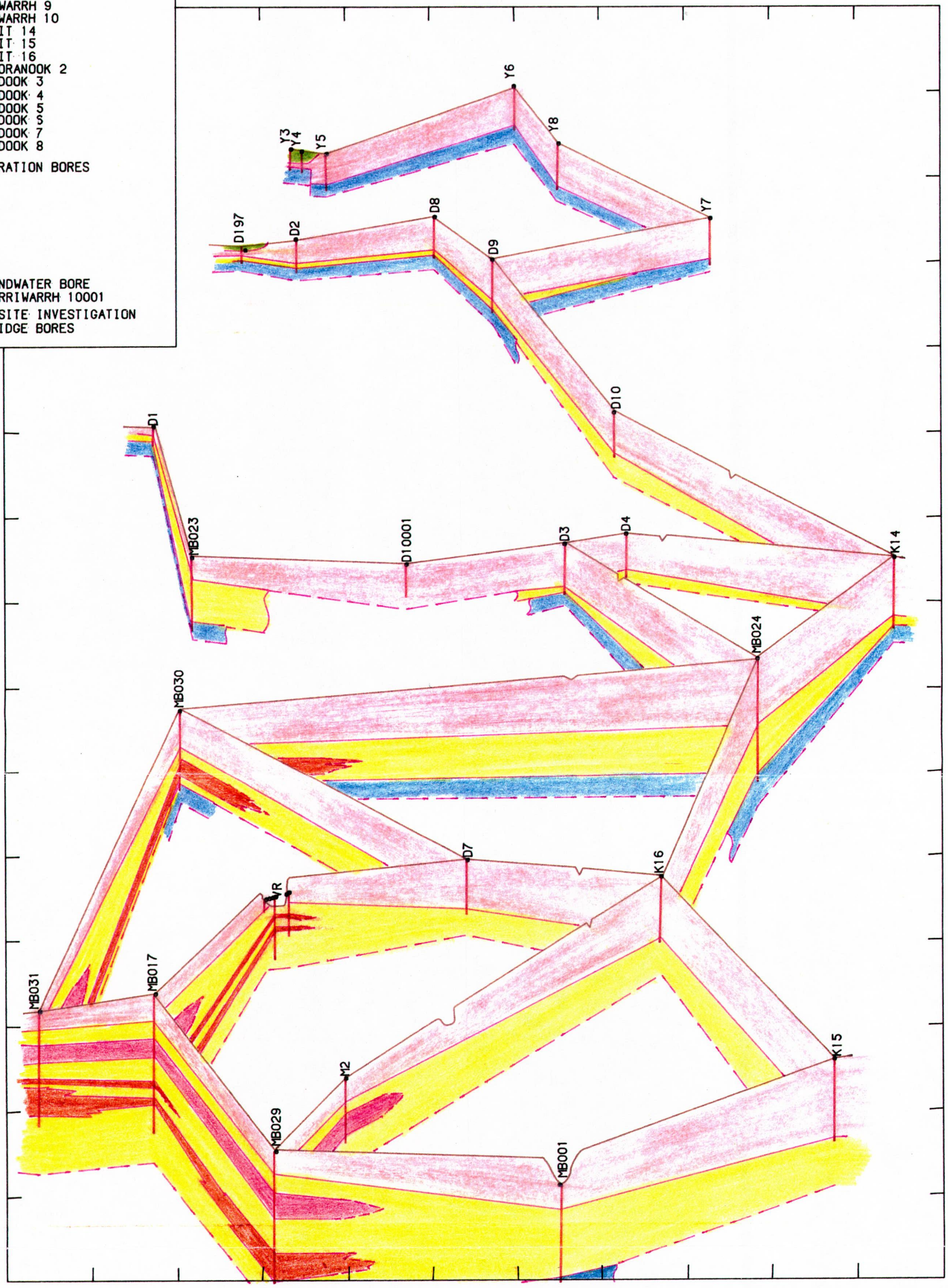
PRIVATE GROUNDWATER BORE

D10001 DJERRIWARRH 10001

ENGINEERING SITE INVESTIGATION

VR RAIL BRIDGE BORES

This map is to be used only for preliminary studies and is not intended as a substitute for on-site investigation.



0 2500 5000metres

HORIZONTAL SCALE 1:50000 VERTICAL EXAGGERATION = 10

0 50 100 150 200 250metres

VERTICAL SCALE 1:5000

LEGEND

QUATERNARY ALLUVIAL DEPOSITS
Gravel, sand and silt

TERTIARY NEWER VOLCANICS
Basalt and scoria
with interbedded alluvial
deposits and palaeosols

TERTIARY OLDER VOLCANICS (?)
Basalt and derived
palaeosols

TERTIARY ALTONA COAL SEAM (?)
Lignite, with sand, silt
and clay intercalations

TERTIARY WERRIBEE FORMATION (?)
Gravel and sand,
with silty clay layers

ORDOVICIAN BEDROCK
Interbedded shale, greywacke
and sandstone

DEPARTMENT OF INDUSTRY
TECHNOLOGY AND RESOURCES

GEOLOGICAL SURVEY OF VICTORIA

ENGINEERING GEOLOGICAL MAPPING
OF MELTON, VICTORIA.

Figure 4.
SUBSURFACE STRATIGRAPHY

PROJ NO. GE 14 | DATE: 10-MAY-87

7 Soil Depth

The soil depth map (Fig. 5) is presented as a conceptual map intended to convey an overall picture of the variation in soil thickness, rather than a precise map. The use of shade colour is a better format for vividly illustrating the variation than isopleth lines, since the numeric surface is not very "smooth".

As the soil depth map is the most liable to misuse, a deliberate attempt has been made to impress upon the map user that the map represents a surface derived from a statistical analysis of the data, rather than a real surface. To this purpose a reliability diagram has been included.

The data set comprised 648 sampled points. Semi-variograms of the data set show that the soil depth is predictable to within a half-metre; spatially dependant to four hundred metres of the sample point; the values are isotropic in distribution; and there are no regional trends. The map was derived from block kriging 100 metre X 100 metre areas. Soil depth was taken to mean the depth to power-auger and/or back-hoe refusal.

8 Rockhead Contours.

The contours of the rock surface shown in Figure 6 are simply derived from the subtraction of the soil depth grid from the topographic surface. To avoid giving the user a false impression of accuracy, the map has been presented using a 10 metre contour interval. It is intended for the preliminary investigations for such engineering problems as storm water drainage and outfall sewers.

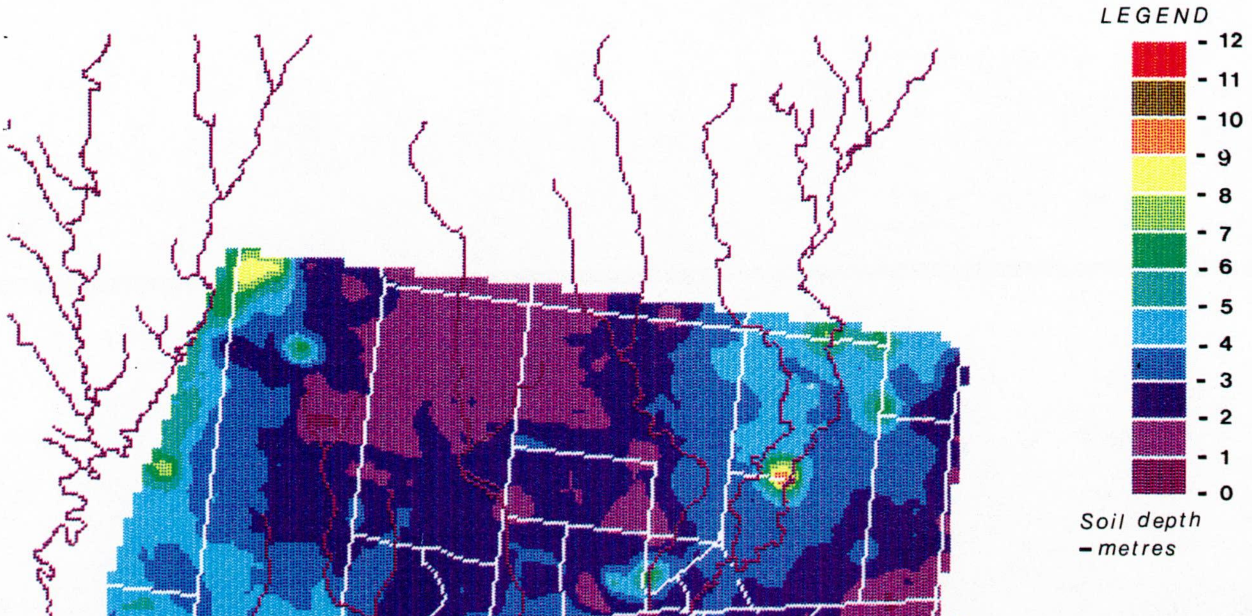
9 Standing Water Levels.

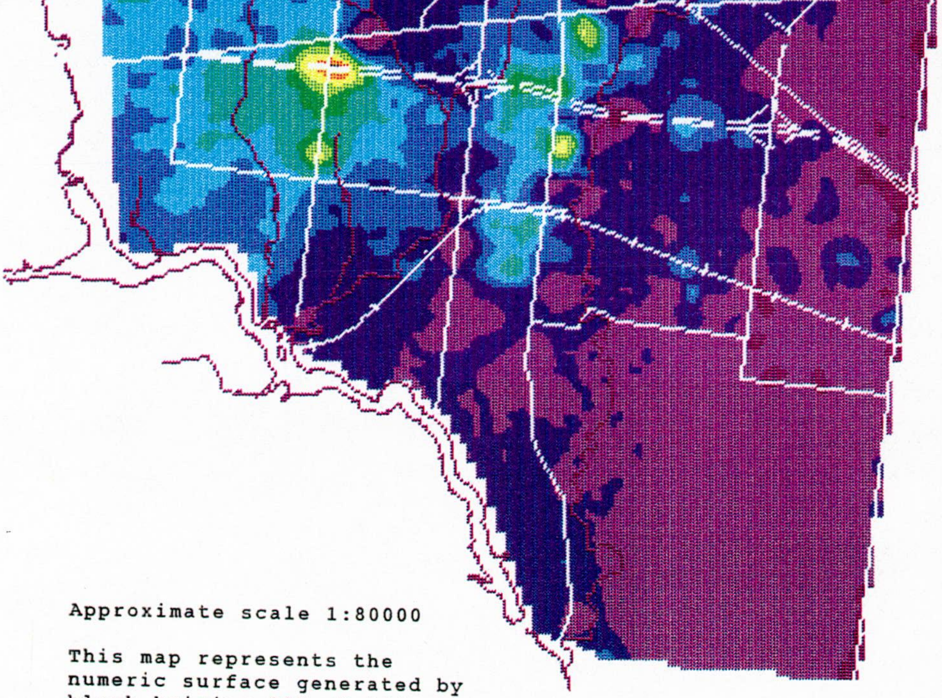
The standing water levels are represented by a contour map at a scale of 1:50000. It was computed from only 36 known water levels in the groundwater bores researched.

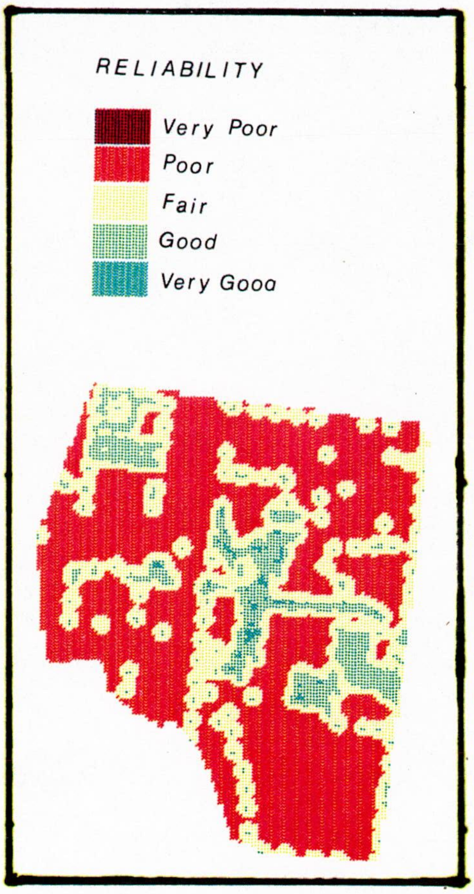
Essentially the groundwater in the region occupies the two major sub-horizontal geological formations, the Newer Volcanics and the Werribee Formation. The standing water level illustrated in the map represents the depth to the unconfined water table aquifer.

Generally, two separate aquifers are encountered in the Melton region. The upper basalt aquifer - the unconfined water-table aquifer - is recharged by direct slow infiltration of rain or stream water. The lower basalt aquifer is a confined low pressure aquifer separated from the upper aquifer by interbedded soil layers of low permeability in the basalt. Water enters the lower aquifer in areas where it locally outcrops and partly also by vertical leakage from the upper aquifer in places where the low permeability interbeds are lacking.

This map is to be used only for preliminary studies and is not intended as a substitute for on-site investigation.





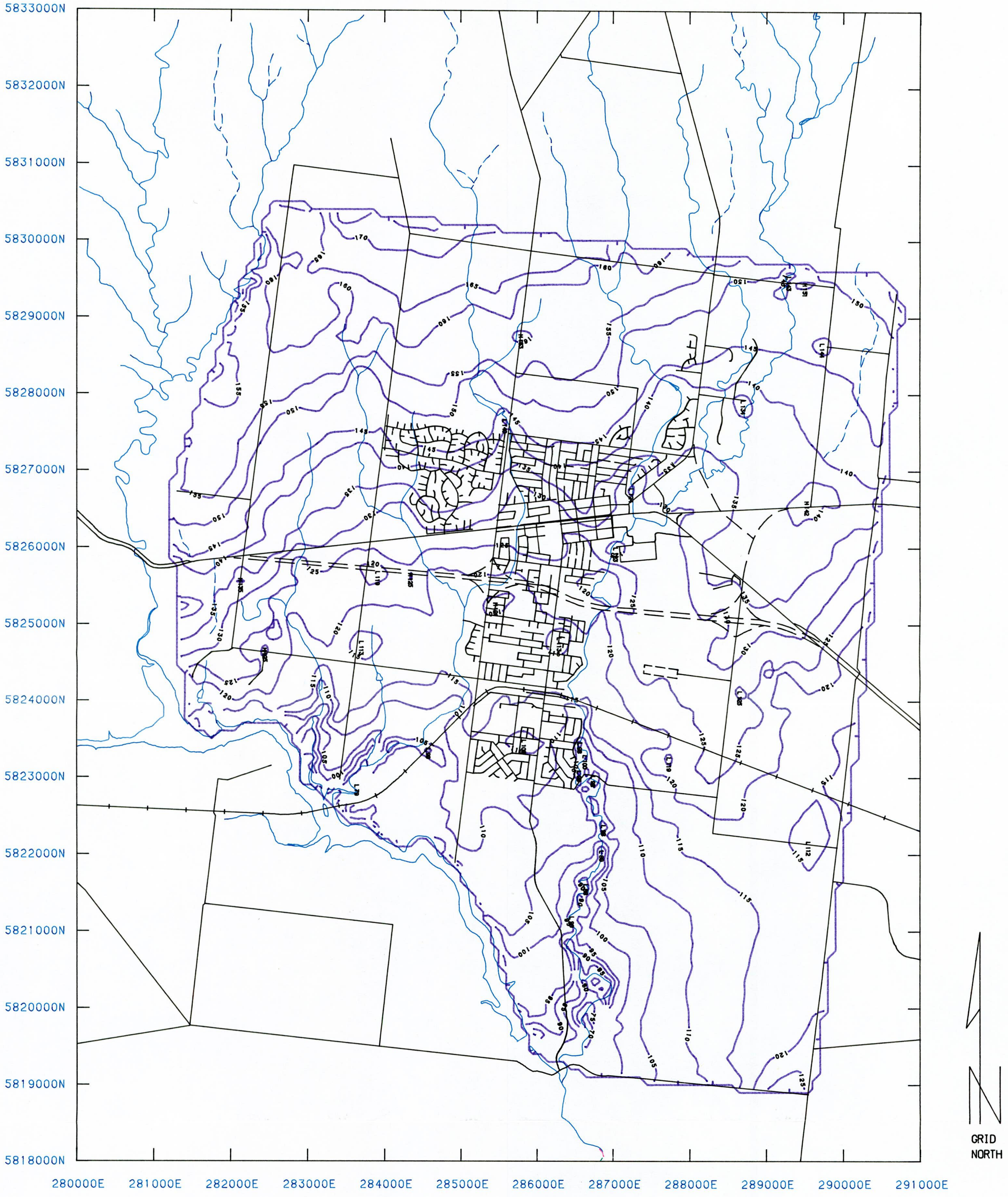


Approximate scale 1:80000

This map represents the numeric surface generated by block kriging 100m X 100m areas. The soil depth shown is the average value over the 10,000 m² cell.

Figure 5. Soil depth map.

This map is to be used only for preliminary studies and is not intended as a substitute for on-site investigation.



0 2500 5000metres

SCALE 1:50000

LEGEND

Contour interval - 5m.
Datum - Australian Height Datum

Computed as:
Topographic Surface Model minus Soil Depth Model

DEPARTMENT OF INDUSTRY TECHNOLOGY AND RESOURCES

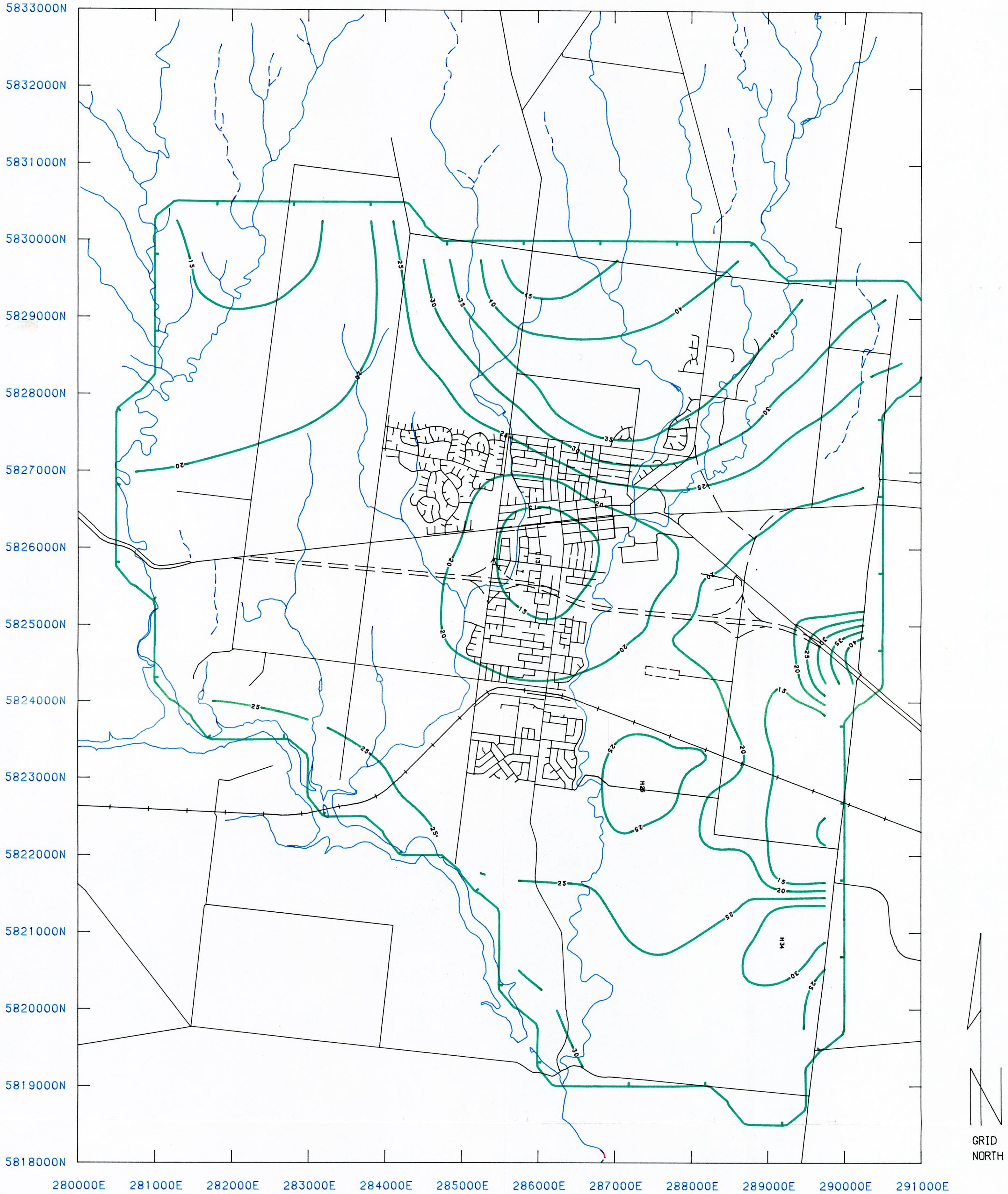
GEOLOGICAL SURVEY OF VICTORIA

ENGINEERING GEOLOGICAL MAPPING OF MELTON, VICTORIA.

Figure 6.
ROCKHEAD CONTOURS

PROJ NO. GE 14	DATE: 3-FEB-88

This map is to be used only for preliminary studies and is not intended as a substitute for on-site investigation.



0 2500 5000metres

SCALE 1:50000

LEGEND

Depth from the surface to the standing groundwater level is shown in metres

DEPARTMENT OF INDUSTRY TECHNOLOGY AND RESOURCES

GEOLOGICAL SURVEY OF VICTORIA

ENGINEERING GEOLOGICAL MAPPING OF MELTON, VICTORIA.

Figure 7.

STANDING GROUNDWATER LEVEL

PROJ NO. GE 14 | DATE: 17-NOV-87

10 Groundwater piezometric surface

The groundwater piezometric surface was computed by subtracting the standing water level numeric surface from the topographic surface. It is also presented at 1:50000 scale (Fig. 8).

In general terms, the groundwater in the Melton area is of the sodium chloride type with some magnesium sulphate. Almost all the groundwater recorded has levels of total dissolved solids higher than generally recommended for human consumption. In most cases it would provide suitable drinking water for livestock.

11 Sand and Gravel potential

Although detailed exploration and evaluation of the sand and gravel will be required to establish the location of reserves, the map (Fig. 9) is intended to indicate those areas which have the highest potential. To properly evaluate the potential such factors as thickness of the deposit, its quality, the degree of sterilisation, and the depth of overburden need to be known.

This map combines factors from the soil depth map, geology and geomorphology map, standing water level map, and the subsurface geology map. No information on the quality or grading of the deposits is available.

Essentially, two types of resource are possible. The unconsolidated sand and gravel material from the alluvial deposits, and the hard rock material available from the basalt flows. In the past, the alluvial deposits have been worked by small pits at Exford, and along Djerriwarrh Creek. A hard rock resource has been located for commercial quarrying in the east of the Development Area.

12 Site classification

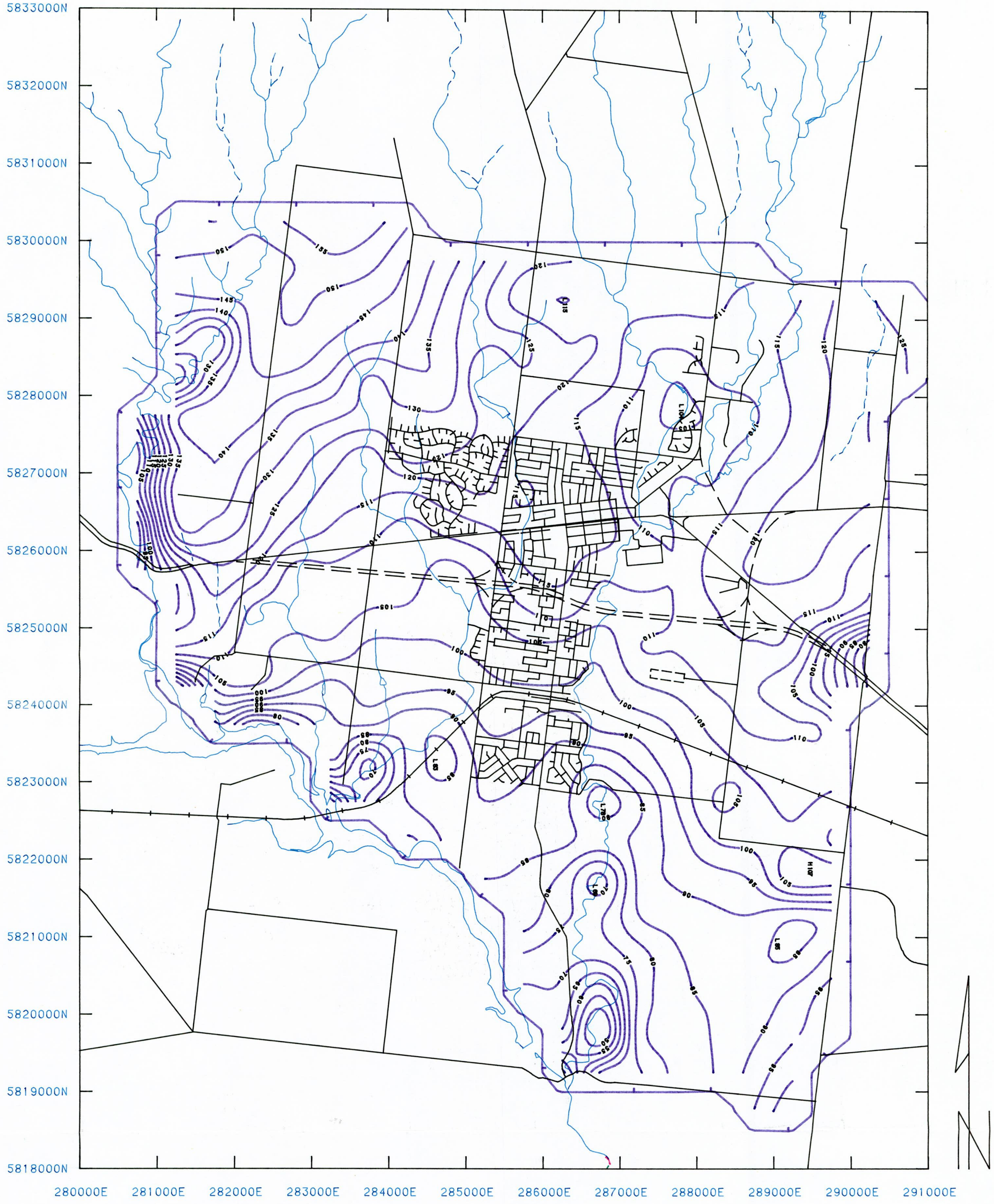
The site classification map (Fig. 10) is a first attempt at delineating the site classes designated in Australian Standard AS2870-1986 (Residential slabs and footings). The map combines the information from the geology, geomorphology, test data, and soil depth. It is presented at 1:50000.

The major problem site in the north west of the Development area is affected by soil subsidence. The subsidence mechanism is attributed to the dessication and deep cracking of the very thick reactive soils which underlie the slightly cemented silty sand topsoil.

The extremely reactive sites (class E) are delineated on soil test data combined with soil thickness. Similarly the highly reactive sites (class H) are the thicker soils or clays with a high swell potential.

Class M (moderately reactive sites) are generally the alluvial areas and the thin soil areas.

This map is to be used only for preliminary studies and is not intended as a substitute for on-site investigation.



0 2500 5000metres

SCALE 1:50000

LEGEND

Contour interval - 5m.
Datum - AHD

Computed as:
Topographic Surface model
minus Standing Water Level Model

DEPARTMENT OF INDUSTRY TECHNOLOGY AND RESOURCES

GEOLOGICAL SURVEY OF VICTORIA

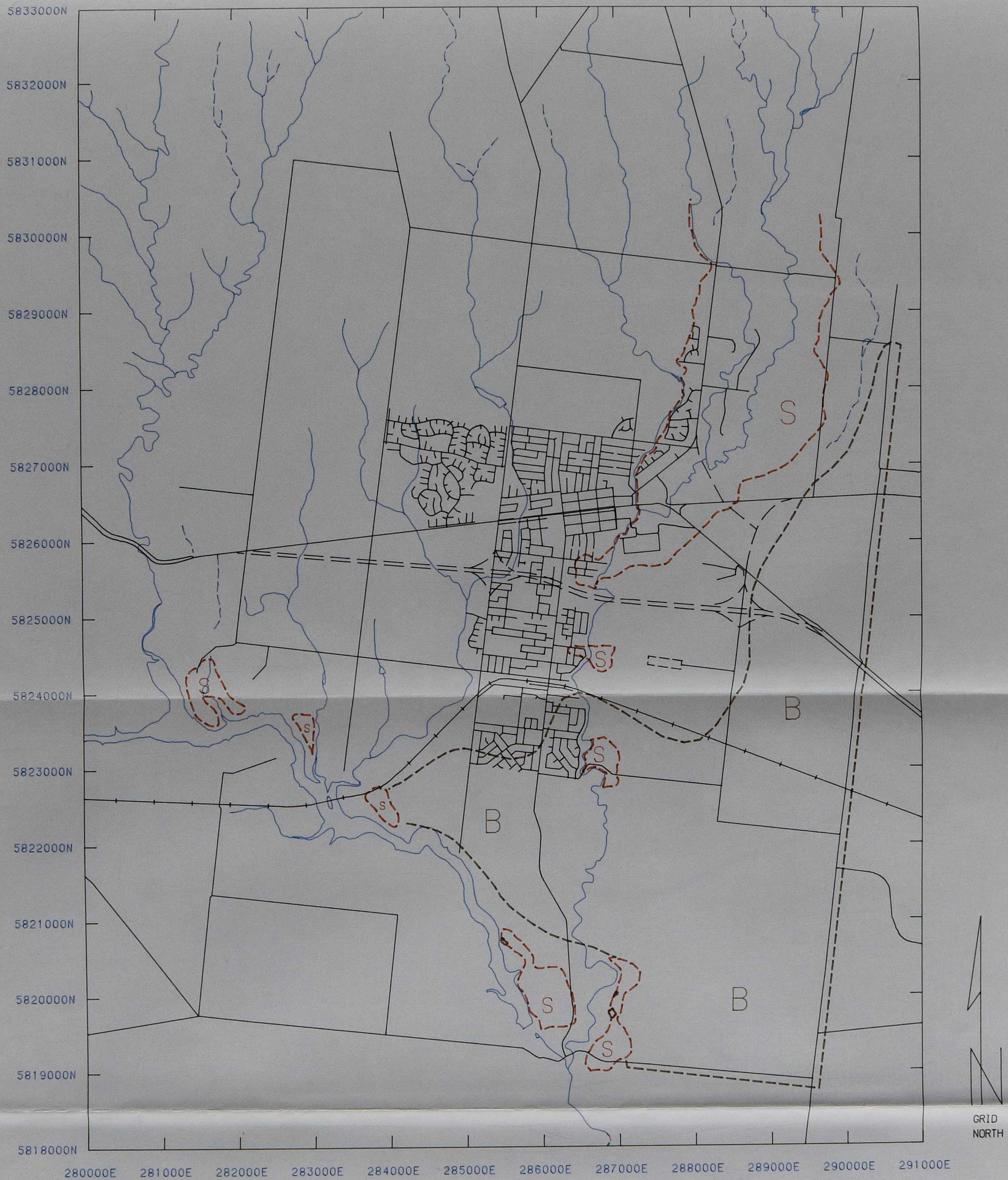
ENGINEERING GEOLOGICAL MAPPING OF MELTON, VICTORIA.

Figure 8.
POTENTIOMETRIC SURFACE

PROJ NO. GE 14	DATE: 17-NOV-87

Geological Survey of Victoria
Unpublished Report 1986/7

This map is to be used only for preliminary studies and is not intended as a substitute for on-site investigation.



0 2500 5000metres

SCALE 1:50000

Information collated from:
Surface geology
Subsurface geology
Soil depth
Standing groundwater level

Note:
No information on material quality is available.

LEGEND

S Sand and gravel potential

B Hard rock potential

ITR DEPARTMENT OF INDUSTRY TECHNOLOGY AND RESOURCES

GEOLOGICAL SURVEY OF VICTORIA

ENGINEERING GEOLOGICAL MAPPING OF MELTON, VICTORIA.

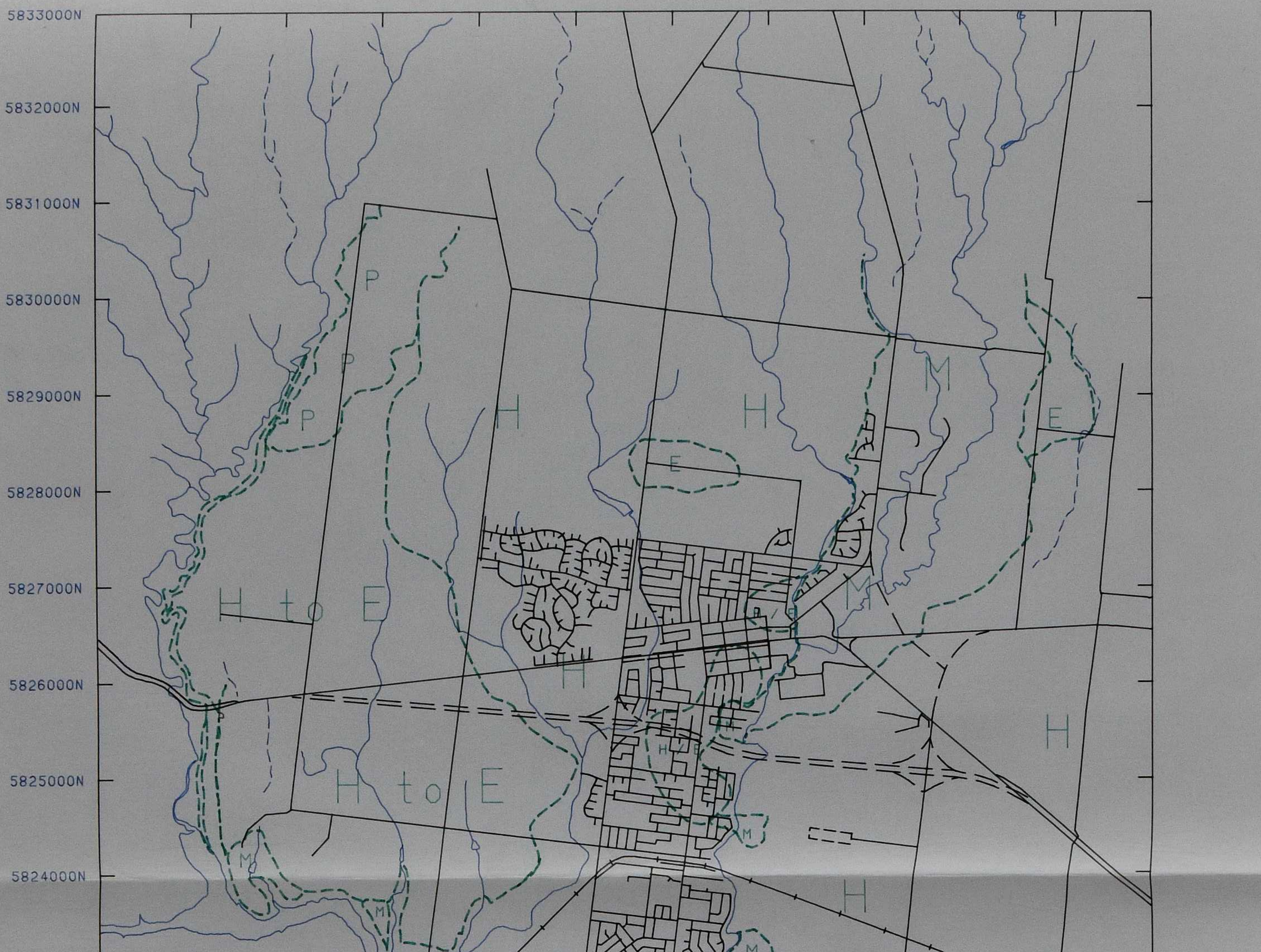
Figure ~~X~~ 76

SAND AND GRAVEL POTENTIAL

PROJ NO. GE 14	DATE: 5-JAN-88

Geological Survey of Victoria
Unpublished Report 1988/7

This map is to be used only for preliminary studies and is not intended as a substitute for on-site investigation.



SCALE 1:50000

SITE CLASSIFICATION -
AUSTRALIAN STANDARD AS2870

Foundation	Character	Class
Moderately reactive clay	Reactive	M
Highly reactive clay		H
Extremely reactive clay		E
Subsidence area or uncontrolled fill	Problem	P

Geological Survey of Victoria
Unpublished Report 1988/7

ITR DEPARTMENT OF INDUSTRY TECHNOLOGY AND RESOURCES

GEOLOGICAL SURVEY OF VICTORIA

ENGINEERING GEOLOGICAL MAPPING OF MELTON, VICTORIA.

Figure ~~16~~. 17
SITE CLASSIFICATION

PROJ NO. GE 14	DATE: 5-FEB-88

13 Engineering Geological Units

The map of engineering geological units (Fig. 11) represents an attempt at collating the information gained by the engineering geological mapping program. It is presented at 1:25000 scale.

Three types of information are illustrated on the map:

1 Geological features pertinent to Engineering
  * Engineering geological units
  * Geomorphic features
  * Filled farm dams
  * Government bores

2 Cultural information pertinent to engineering geology
  * Farm dams
  * Quarries and/or sand and gravel pits
  * Basemap information (roads, rail-line, creeks and larger water storages)
  * Parish boundaries

3 Map information
  * Scale bar, AMG co-ordinates, north arrows and title information.

13.1 Geological features

The enineering geological units are represented by Genesis-Lithology-Qualifier (GLQ) stack symbols (Keaton, 1984). The benefit of using GLQ symbols is that the geological origin is revealed (Genesis) as well as the material type (Lithology) for each layer. Thus for the units shown on the map:

Asmc - Alluvial sands, silts and/or clay
A/Rmc - Alluvial and/or residual silt and/or clay
Rmc - Residual silt and/or clay
BA - Basalt rock

The units were derived from an examination of the soils and rocks encountered during the drilling program, combined with the surface and subsurface geological information.

13.1.1 Asmc unit

The Asmc units are identified as primarily alluvial in origin, generally comprising sandy clays, silty sands, sandy silts with occasional gravel layers in the profile. The sand and gravel is generally quartzose, with minor occurences of sandstone, basalt and ironstone (buckshot) gravel. The clay fraction of the soil is generally montmorillonitic and highly plastic. It is not possible to summarize the properties of this unit, as there is a great varation in local composition, including variation down a profile.

The boundaries of the unit were delineated from aerial photography interpretation, followed by intensive field mapping.

13.1.2 A/Rmc unit

The A/Rmc unit is a compromise for areas which were frustratingly difficult to interpret. This unit occurs in two locations - the large unit west of the City of Melton, and a small area in the north-east of the development area.

The most striking feature of this unit is the thickness of highly expansive clay material. In most of the unit the thickness exceeds four metres, with up to ten metres being recorded in bore Djerriwarrh 106.

Typically, a profile exhibits a red-brown silty clay surface horizon, then becomes stiff to very stiff clay, silty clay or sandy clay by 50 cm. depth. Often calcrete nodules or sandy material occurs at approximately one metre depth. Below this, a stiff to very stiff mottled yellow-brown and grey, fissured clay occurs. Often this clay will become very sandy or silty, and occasionally gravel beds up to 30 cm. thick are intersected. The fissure surfaces are often lined with very fine sand grains and slickensided surfaces were common in the core. No obvious layering or bedding features were observed.

Testing on samples recovered during drilling determined the highly plastic nature of the clay material. The clay is predominately montmorillonitic.

The boundaries of this unit were delineated by aerial photograph interpretation and borehole information. No boundary is evident on the surface.

13.1.3 Rmc unit

The Rmc unit represents the residual clay, silty clay and clayey silt derived primarily from the weathering of the basalt. Some minor non-basaltic material, chiefly aeolian sands and silt, and alluvial sands also occur in this unit.

Typically, the soils of this unit identified by a red-brown silty clay, clayey silt and occasional sandy clay surface horizon which frequently contains buckshot sands and gravels. Down the profile, the material changes to a brown to grey-brown stiff to very stiff clay with calcrete nodules or sandy material frequently occuring between one and two metres deep. Where the soil is shallow, the calcrete will occur immediately above the basalt rock. In bores deeper than 1½ metres, the clay becomes grey or mottled yellow-brown and grey.

The soils of this unit are almost all less than three metres thick, with large areas less than two metres thick. The engineering properties derived from testing show considerable variation. In the area immediately north of Centenary Avenue, along Raleighs Road, the soil exhibited extremely high liquid limit and free swell values (in fact the highest recorded during the test program), whereas in most of the south-eastern portion of the mapsheet the values were moderate.

13.1.4 Other geological information

Other information pertinent to engineering and planning has mostly been presented on the preceeding individual maps. Included here are the major geomorphic features of the Newer Volcanics, intended to draw the map-user's attention to areas where very shallow soils and floaters may occur (the basalt flows), and slightly deeper and poorly drained organic soils may occur (the depressions). Farm dams identified from historic aerial photographs and not visible on recent aerial photography have been marked as fill area. The type or condition of the fill is unknown. Government bores are shown to indicate locations where information is freely available.

13.2 Cultural features

Farm dams recognised from aerial photograhs have been plotted to provide locations where future filled areas may occur. Development over filled dams may lead to problems such as differential settlement in structures, and severe changes in the soil moisture regime. Similarly disused quarries and/or pits attract unengineered fill, which may be hazardous for future development. Basemap information is provided for location purposes, and has been kept simple to avoid confusion of data. Topographic contours, although desirable, presented a difficulty for presentation on a line drawing, with overprinting of data posing a problem.

The parish boundaries are included for bore identification, since the GSV bore numbering system records the consecutive number for each parish.

14 Map Revision

The use of computer facilities to provide the engineering geological information should facilitate the frequent revision of the individual maps presented. As more information is added to the database, the generation of revised maps can be frequently undertaken with relative ease. Similarly, the deficiencies in the basemap information can be redressed as they are revealed.

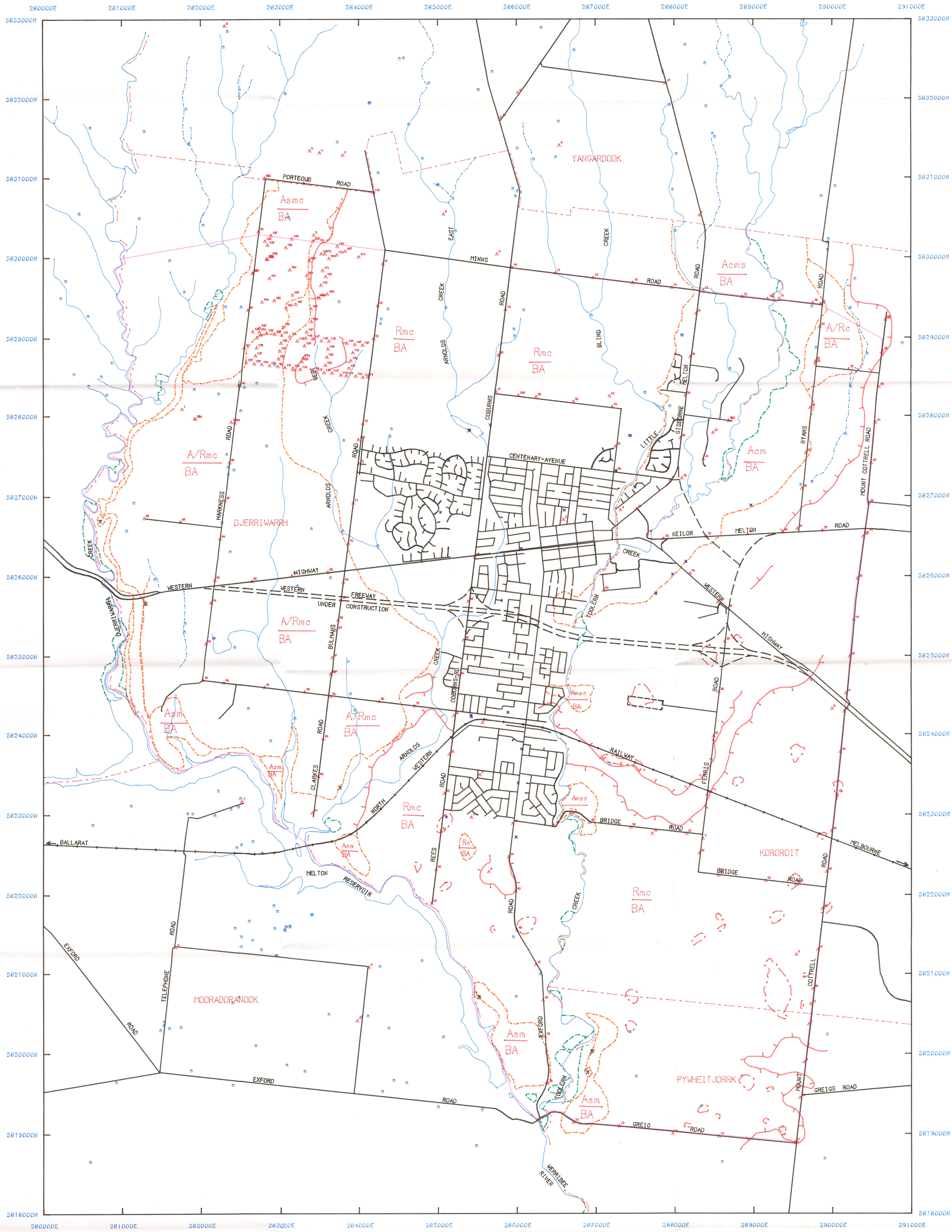
The Melton engineering geological mapping project initiates the use of computer generated maps in the GSV. Although no mechanism has been installed for automatic updating of the maps, an information database has been established, which links with a central data base of bore information retained by the GSV. As more sophisticated software systems become available, the future use of CAD packages to produce inexpensive full colour maps is inevitable.

15 Conclusion

Every map is a reflection of a myriad of decisions made by the map maker and represents just one way of looking at reality. It is not a copy but a semblence of reality, filtered by the map makers motives and perceptions. Knowledge skill, and integrity all enter into the map design such that the map is partly a representation of reality and in part a product of its maker.

A map can be remarkably uesful as long as the user doesn't ask it to do things for which it wasn't designed. A map cannot be the same as reality; if it were it would lose its unique clarifying function. These maps are designed to provide the first look at the engineering geology of the area, so that making a decision on land-use is done with the best available knowledge.

This map is to be used only for preliminary studies and is not intended as a substitute for on-site investigation.



0 — 2500 — 5000metres

SCALE 1:25000

LEGEND

Asmc BA	Alluvial soils	sandy silts, silty clays, sandy clays, etc. over weathered Newer Volcanics, chiefly basalt (BA)
A/Rmc BA	Alluvial and residual soils	sandy silts, silty clays, sandy clays, etc. over weathered Newer Volcanics, chiefly basalt (BA)
Rmc BA	Residual soils	weathered from Newer Volcanic basalt flows (BA)

- Boundary of engineering geological unit
- Boundary of basalt flow
- Surface depression
- KOROR — Parish name
- △13 — Government bore
- ○ — Farm dam
- × — Filled farm dam
- ⌧ — Quarry

GRID NORTH
MAGNETIC NORTH

DEPARTMENT OF INDUSTRY
TECHNOLOGY AND RESOURCES

GEOLOGICAL SURVEY OF VICTORIA

ENGINEERING GEOLOGICAL MAPPING OF MELTON, VICTORIA.

ENGINEERING GEOLOGY UNITS

PROJ NO.	DATE: 14-MAY-87