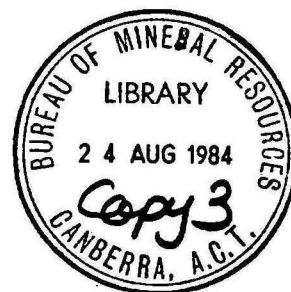


1984/23

03

BMR PUBLICATIONS COMPACTUS
(LENDING SECTION)



BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD 1984/23

RECORD

MURRAY BASIN HYDROGEOLOGICAL PROJECT

PROGRESS REPORT 11

for half year ending 31 March 1984

compiled by

W.J. Perry

RECORD 1984/23

MURRAY BASIN HYDROGEOLOGICAL PROJECT

PROGRESS REPORT 11

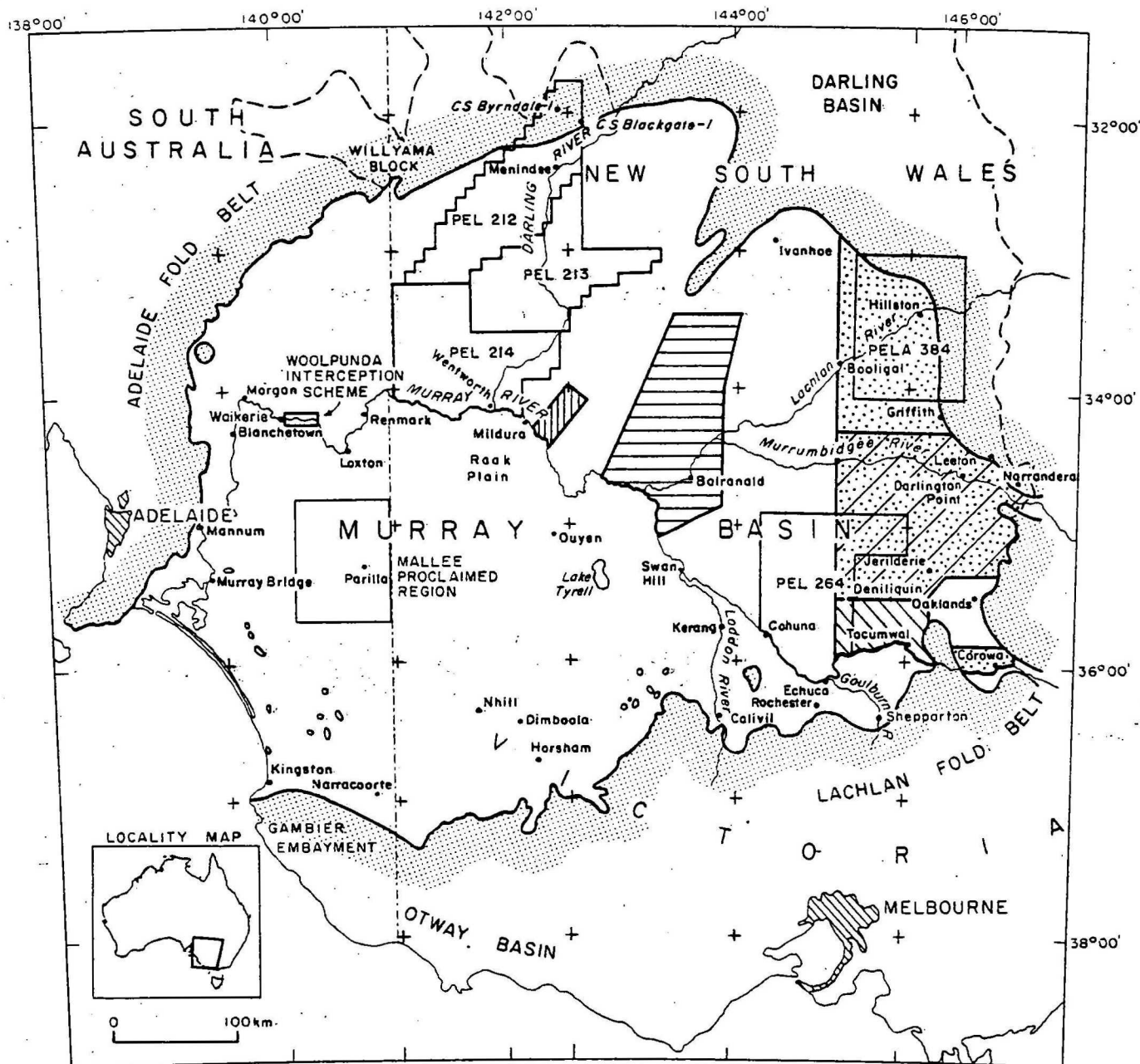
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


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(Based on 19/A/10)

19/A/59

Water Resources Commission of NSW

- | | |
|--|---|
|  Mallee Cliffs |  Murrumbidgee Report |
|  Geophysical Survey |  Tocumwal Drilling Program |
|  Long Term Monitoring | |

INTRODUCTION

Work continued on the compilation of the geological map of the Basin and associated figures. The Steering Committee met in December during the International Conference "Groundwater and Man" at the University of New South Wales, and one outcome of the meeting was the provision of a statement on the current status of the Project to the Victorian Parliamentary Salinity Committee, the Interim Council of the Institute of Freshwater Studies, and the River Murray Commission. During the period Dr R.S. Evans was nominated to represent the Victorian State Rivers and Water Supply Commission on the Steering Committee.

PROGRESS REPORTS

SOUTH AUSTRALIAN DEPARTMENT OF MINES AND ENERGY

by

S.R. Barnett

Apart from routine monitoring of observation networks, most activity has concentrated on preparation for a feasibility study for the Woolpunda Interception Scheme. This project aims to intercept saline groundwater inflows between Locks 2 and 3 which have been estimated at 250 tonnes of salt per day. A drilling program involving six fully cored holes through the Murray Group limestone aquifer is about to commence. A Sirotem geophysical survey was carried out in an attempt to detect lineaments or fracture zones which may concentrate groundwater inflows into the river. Initial results appear promising.

Two stand-by town water supply wells have been drilled in the Mallee region at Geranium and Parilla. Aquifer tests will be carried out using these new wells as observation wells.

The Mallee Water Resources Advisory Committee has decided on land use as a management tool i.e. by considering the water requirements of certain irrigated crops compared to lucerne. This decision will be reviewed at the conclusion of the water balance study.

Reports presenting composite logs of the recent regional drilling program are in preparation.

WATER RESOURCES COMMISSION OF NEW SOUTH WALES

1. Drilling

The second and third bores at Mallee Cliffs have been drilled. The second bore was drilled to the east of the bedrock ridge to a total depth of 405 m. It encountered:-

0	-	6m	Coonambidgal Fm
6	-	56m	Parilla Sand
56	-	169m	Geera Clay
169	-	244m	Duddo Limestone
244	-	280m	Geera Clay
280	-	394m	Olney Fm (Limestone and marl 344-394m)
394	-	405m	phyllite

The third bore was drilled to the base of Parilla Sand west of the bedrock ridge. It encountered:-

0	-	7m	Coonambidgal Fm (?)
7	-	47m	Parilla Sand
47	-	56m	Geera Clay

Piezometers in the Olney Formation and Parilla Sand have been installed and pumping tests are currently being carried out.

Micropalaeontological examination by V. Scheibnerova, Dept of Minerals and Energy, N.S.W. of samples from the first bore is still being undertaken.

Seven bores in the Tocumwal-Deniliquin area are planned but the commencement date is unknown. They will be used to monitor the good quality groundwater associated with Tertiary sediment aquifers known to supply large yields of good quality groundwater to suitably constructed bores.

2. Geophysical surveys

A total of 46 km of seismic refraction traverses and 13 electric resistivity soundings were carried out during the period in the Lachlan and Murrumbidgee groundwater areas of the Murray Basin.

3. Water level and water quality recording

Monitoring of water levels and water quality continued in the Commission's observation bore network in the eastern part of the Basin.

4. Clay analysis samples

A report based on clay samples from 25 bores in the Coleambally-Darlington Point area is currently in a draft stage, and awaiting draughting of figures. It outlines the groundwater hydraulics and hydro-chemical changes which occur in the area. The completion of the report depends largely on the availability of draughting staff.

The clay analyses make a significant contribution in the understanding of the Tertiary geology, hydrochemistry and the hydrochemical evaluation of groundwater through the aquifers. A similar program in the Lower Lachlan area will be undertaken if funds become available.

5. Location of bores

The replotting of bore locations in the N.S.W. Section of the Murray Basin will be complete within three weeks, as a result of assistance from BMR.

STATE RIVERS AND WATER SUPPLY COMMISSION OF VICTORIA

by

R.S. Evans

1. An Airborne Electromagnetic Survey of parts of the Shepparton Region was carried out by Geoterrex Pty. Ltd. to determine the feasibility of locating shallow freshwater aquifers by this method.
2. Modelling of groundwater flow in the Girgarre area (Shepparton Region) continued and a calibration period of one year's record was completed.
3. A draft report on the geology and hydrogeology of the Campaspe Irrigation District was completed and options for salinity control in that area were considered.
4. Nyah - South Australian Border Hydrogeological Project. Drilling has been underway for several months now to define the hydrogeology of a 25 km wide strip on the Victorian side of the Murray River from Nyah to the South Australian Border. This project is aimed at providing basic data to enable a rational assessment to be made of the effects of possible irrigation using water derived from Dartmouth Dam. It is intended to drill approximately 7 bores, to a depth of 25 m on each of 26 section lines.

GEOLOGICAL SURVEY OF NEW SOUTH WALES

by

D.H. Probert

1. Petroleum Exploration

a) Petroleum Licence Changes

- i) PELA 384 was granted as PEL 266 to Comserv (No 779) Pty Ltd
- ii) PEL 264 previously held by Balhoil Nominees P/L has now lapsed.

b) Drilling Activity

Menindee-Tarara Troughs (PELs 212, 214)

Esso Australia Ltd has recently undertaken an extensive stratigraphic drilling program within the Menindee - Tarara Troughs which are infrabasins of the Murray Basin. The object of this program has been to test for the presence of a prospective Permo-Carboniferous sequence.

- 1. Esso Pamamaroo No 1 was drilled within the Menindee Trough and reached a total depth of 801 m within Devonian redbeds. Only a relatively thin section of Permo-Carboniferous sediments was intersected in this hole.
- 2. Esso Ennisvale No 1, drilled within the Tarara Trough, reached a total depth of 1230 m in early November 1983. A significant thickness of post-Devonian - pre-Tertiary sediments was intersected and a number of hydrocarbon shows were detected throughout this section.
- 3. Esso Nulla Nulla No 1 was also drilled within the Tarara Trough and encountered a similar sedimentary sequence to that encountered in the Ennisvale well. A total depth of 1119 m was reached at the end of November.
- 4. Esso Popiltah No 1 within the Tarara Trough (probable Permo-Carboniferous sediments) penetrated 1002 metres.

2. Coal Exploration

a) Authorisations Nos 207 and 250 Mitsubishi Development Pty Ltd.

Six (6) boreholes were drilled during the period. Three were drilled in the southernmost portion of the area for coal seam and structural data. Three holes were drilled as part of a mine feasibility. In all 133 boreholes including 8 for water evaluation have been drilled within the authorisations.

Coal utilisation studies also continued during the period.

b) Exploration Permit No 5 - Pacific Coal Pty Ltd

During investigation three aquifers were identified, the upper in the Calivil Sands and two within the Permian coal measures sequence. All these are essentially saline and reinjection is being examined as a means of disposal from mine workings.

Exploration data have recently been summarised and a conceptual mining study completed by the Company. Some further assessment is being undertaken.

c) Seismic Exploration Activity

Esso Exploration and Production Aus. Inc. completed 75 km (Survey R83A in PEL's 213 - 214).

GEOLOGICAL SURVEY OF VICTORIA

by

C.R. Lawrence

Much of the hydrogeological reporting has been directed to groundwater as it affects salinity, to conform to the enquiry program of the Victorian Parliamentary Salinity Committee. Information has been supplied for the preparation by consultants of a series of discussion papers, including one on causes and effects, and another on technical controls.

A report has been completed and is soon to be published entitled, "Groundwater resources and associated salinity problems for the Victorian part of the Riverine Plain" by S.J. Tickell and W.G. Humphrys. In essence this report indicates that there is a complex of aquifers and aquitards beneath the Riverine Plain through which groundwater moves both horizontally and vertically at varying rates. The Deep aquifer, an extensive sheet of sand and gravel underlies much of the Plain. It is highly transmissive and is the major aquifer in the area. This is overlain by the Shepparton Formation which consists mainly of silty clay but contains varying proportions of sand. Most aquifers are interconnected to some degree.

The hydrologic cycle has been disrupted by the replacement of the natural vegetation with crops and mainly annual pastures and by the

introduction of irrigation farming. This has resulted in a net increase in recharge to the groundwater system. Consequently groundwater pressures have risen and are still rising in many areas. High water tables have become established under large parts of the irrigated areas. The Loddon Valley north of Bridgewater represents an equilibrium situation where recharge is balanced by outflow, and groundwater pressures at all depths have more or less stabilised at a high level. Elsewhere there is still a net downward movement of groundwater to the Deep aquifer but a similar equilibrium will probably be reached in the next 20 to 50 years, especially in the areas downstream from Rochester and Shepparton. The extent of high water tables and salinity problems will inevitably increase in the future with the effects being worst towards the northwest. Some dryland and land intensity irrigation areas will also be affected.

Sub-surface drainage is essential for maximum productivity in irrigation but at the same time measures designed to reduce inputs to the water table should also be employed where practical, so as to reduce the volume of saline effluent produced. In the long term a proportion of this effluent must be removed from the area to avoid the inevitable build-up of salt in the upper part of the Shepparton Formation.

Deep aquifer pumping may be a viable form of water-table control in dryland and low intensity irrigation areas but could be relatively ineffective in high and moderate intensity irrigation areas.

Considerable quantities of usable groundwater occur in the area. Its future use must be managed in a way which is compatible, both with salinity control and with its conservation as a renewable resource.

With regard to groundwater modelling the simulation of groundwater in the Murray Basin by Dr R Williamson has continued, with emphasis being placed on the reproduction of pressure changes observed over the past decade. A relatively simple model of the Campaspe Valley with thirteen active nodes was calibrated against pressures in four observation bores. One of the more interesting results is that a zone of reduced conductivity and/or cross-section was identified. Recent drilling has found that basement material is indeed closer to the surface than previously thought, thus confirming the modelling predictions.

Attempts were made to represent the dynamics of the prior stream systems, the major point here is that very little is known about the actual pressure fluctuations in the lower permeability sediments, and the interconnection between the sands and silts. Rational and objective management of salt and water in the prior stream systems in the future will require considerable effort being placed on field and numerical evaluations.

Inadequacies in the available records of groundwater extractions were highlighted by the modelling, eg. from irrigation bores, and efforts should be made to prevent installation of pumping bores near observation bores.

A simple salt balance was used in conjunction with the predicted flow rates; it was found that salinity in the deep aquifers can be expected to increase at a rate of about 3% per year under present day rates of extraction. Revised estimates of vertical conductivity and increased understanding of prior stream dynamics can be expected to modify that prediction.

A detailed palynological study is being made by Ms V Archer of the Olney No. 1 bore in the far north-western part of Victoria.

BUREAU OF MINERAL RESOURCES

by

C.M. Brown & R. Evans

Most of the time was occupied in compiling the 1:1 million scale Cainozoic and pre-Cainozoic maps of the Basin, associated figures to be shown on the face of the Cainozoic geology map - Eocene, Miocene and Pliocene palaeogeographic diagrams - petroleum wells and mineral occurrences, representative sand dunes and the detailed references. Compilation was still in progress at the end of the period. C.M. Brown completed a synopsis of basin geology for the ESCAP Atlas of Stratigraphy and A.E. Stephenson spent some time on a paper on Lake Bungunnia and the distribution of the Blanchetown Clay

Work on the hydrogeological phase was concerned mainly with the acquisition of the basic hydrogeological data from the State water authorities. These data are being stored in an in-house water data base. Support was provided to the Water Resources Commission of New South Wales to help with

the transfer of bore locations from existing plans to Australian Metric Grid coordinate maps. Topographic information was sought from State collaborators for input to the digital terrain model of the Basin which is to be prepared by the Australian Survey Office.

During December 1983, R. Evans, in association with Drs J. Bowler and P. Macumber, escorted a group of Chinese salt lake scientists through the basin to look at Quaternary salt lakes, their associated deposits and their hydrology.

RECENTLY PUBLISHED AND UNPUBLISHED REPORTS ON THE GEOLOGY AND HYDROGEOLOGY
OF THE MURRAY BASIN

Brown, C.M., 1983 - Discussion: A Cainozoic history of Australia's Southeast Highlands, Journal of the Geological Society of Australia. 30, 483-486.

Macumber, P.G., 1983 - The interrelationship between groundwater and surface water systems in northern Victoria, Ph.D thesis, University of Melbourne.

APPENDIXMurray Basin Hydrogeological Project

Description and status, December 1983

This project is a long-term study which is being undertaken jointly by South Australian, Victorian and New South Wales geological surveys and water authorities and by the Commonwealth Bureau of Mineral Resources, Geology and Geophysics. It is co-ordinated by a Steering Committee comprising members of those organisations.

The Murray Basin is a geological structure with an areal extent of some 300 000 km². In each of the three States the basin sediments contain very large groundwater reserves. Where the groundwater has a low salinity it is increasingly being used for irrigation and town water supply purposes. In much of the basin, the groundwater is suitable only for stock use and is extensively used for this purpose. In other parts of the basin the groundwater is too saline for any use. There is a complex interaction between groundwater and surface water which may be beneficial, as in recharge areas in some parts of the basin, or harmful as in areas of saline groundwater discharge to rivers. In recent years, the states involved have stepped up the rate of assessment of the groundwater regime in the basin.

The primary aim of the Project is to improve the understanding of the groundwater regime of the basin by examining it as a single entity, unencumbered by State boundaries. Since a knowledge of the geology of an area is basic to the understanding of groundwater occurrence, a geological study of the basin is an essential part of the Project and as a consequence it will also be possible to make an assessment of other mineral resources.

The Project was planned initially to last five years and is organised in five phases:

- (1) Geological synthesis, using all available geological and geophysical data.
- (2) Hydrogeological assessment, on the basis of available data.
- (3) Documentation of deficiencies in geological and hydrogeological information and formulation of proposals for appropriate work programs.

- (4) Additional work as approved which could include stratigraphic drilling, aquifer testing, biostratigraphic analysis and isotope hydrology studies.
- (5) Development of numerical model(s), if found to be appropriate in the light of the data then available.

The geological synthesis is nearing completion, and a draft document reporting results with accompanying 1:1 scale geological maps is expected to be finished by late 1984.

Phase 2 began at BMR in 1983. Hydrogeological data available from the States are being entered into a BMR data base designed for the Project; BMR and State workers will prepare a report assessing these data, and the results will be illustrated on several maps including the following:
1:1 million scale maps showing water table, potential contours and salinity variations for the three or four most important hydrostratigraphic units;
1:2.5 million scale maps showing (i) amount of water abstracted-added per unit area (ii) recharge-discharge areas, distribution of aquifer parameters for a 7 layer hydrogeological model. (Both Victoria and South Australia have tested the feasibility of making a preliminary model of the basin as a whole based on a coarse (75 km) rectangular grid).

The hydrogeological assessment and phase 3, the documentation of deficiencies in geological and hydrogeological information are scheduled for completion in 1986.

Additional work required in Phase 4 (e.g. stratigraphic drilling, geophysical investigations) may be conducted by BMR or by appropriate State authorities. The development of a numerical model (Phase 5) if found to be feasible, may be undertaken by BMR or by State authorities. The Project will depend on the close co-operation of staff from all organisations involved, and some movement of staff between organisations for short periods will be necessary. Throughout the study, individuals and organisations will be encouraged to publish results to various aspects of the work. Results of the overall Project will be incorporated into joint publications.