1995/4
V1
C1

AGSO

An inventory of saline water disposal basins, Murray Basin

PUBLICATIONS COMPACTUS
(ON—LENDING—SECTION)

Volume 1

Introduction & References
South Australia
New South Wales

By Stephen Hostetler & Bruce Radke

AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION
14 MAR 1995

RECORD 1995/4



AGSO
AUSTRALIAN
GEOLOGICAL SURVEY
ORGANISATION

Bmr Comp
1995/4
V1
C1

AN INVENTORY OF SALINE WATER DISPOSAL BASINS, MURRAY BASIN

Stephen Hostetler & Bruce Radke [1]

[1] Consultant,
18 Hartley Street, Turner ACT 2601

Prepared as a contribution to NRMS Project M4042
Managing disposal basins to maximize their usefulness for salt storage

Environmental Geoscience and Groundwater Program
Australian Geological Survey Organisation
Canberra

AN INVENTORY OF SALINE WATER DISPOSAL BASINS, MURRAY BASIN

Volume 1

Introduction & References
SOUTH AUSTRALIA
NEW SOUTH WALES

Stephen Hostetler & Bruce Radke [1]

[1] Consultant,
18 Hartley Street, Turner ACT 2601

Prepared as a contribution to NRMS Project M4042
Managing disposal basins to maximize their usefulness for salt storage

Environmental Geoscience and Groundwater Program
Australian Geological Survey Organisation
Canberra

DEPARTMENT OF PRIMARY INDUSTRIES AND ENERGY

Minister for Resources: Hon. David Beddall, MP
Secretary: Greg Taylor

AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

Executive Director: Harvey Jacka

© Commonwealth of Australia 1994

ISSN: 1039-0073
ISBN: 0 642 22321 1

This work is copyright. Apart from any fair dealings for the purposes of study, research, criticism or review, as permitted under the *Copyright Act 1968*, no part may be reproduced by any process without written permission. Copyright is the responsibility of the Executive Director, Australian Geological Survey Organisation. Requests and inquiries concerning reproduction and rights should be directed to the **Principal Information Officer, Australian Geological Survey Organisation, GPO Box 378, Canberra City, ACT, 2601.**

CONTENTS

Volume 1

Introduction 1

Acknowledgements 3

References 4

Figures

1 Distribution of saline water disposal basins along the Murray River 14
2 Location of saline water disposal basins, Waikerie district, S.A 15
3 Location of saline water disposal basins, Barmera district, SA 16
4 Location of saline water disposal basins, Berri district, SA 17
5 Location of saline water disposal basins, Noora, SA 18
6 Location of saline water disposal basins, Renmark district, SA 19
7 Location of saline water disposal basins, Lake Victoria, NSW 20
8 Location of saline water disposal basins, Coomealla-Buronga region, NSW 21
9 Location of saline water disposal basins, Mildura region, Vic 22
10 Location of saline water disposal basins, Nangiloc-Colignan region, Vic 23
11 Location of saline water disposal basins, Robinvale region, Vic 24
12 Location of saline water disposal basins, Swan Hill region, Vic 25
13 Location of saline water disposal basins, Kerang region, Vic 26
14 Location of saline water disposal basins, Cohuna region, Vic 27
15 Location of saline water disposal basins, Griffith region, NSW 28
16 Lithological symbols for stratigraphic cross-sections 29

Appendix

1 Locations and elevations of boreholes used for stratigraphic sections 30

South Australia

Berri 34
Berri Council Stormwater 40
Berri East 45
Block "E" Floodplain 51
Brilka Creek 56
Bulyong Island 62
Cadell 69
Chowilla (Tilmy Flats) 76
Cobdogla 83
Cooltong 89

Disher Creek 95
Hart Lagoon 103
Holder Lagoon 109
K Country 114
Katarapko Island 119
Lake Bonney 126
Lake Merreti (and Clover Lake) 132
Lake Woolpoolool 139
Loveday Basin 145
Loveday South 151
Lyrup East 156
Lyrup South 162
Meander Loop 168
Mid Pike 174
Moorook IA (Watchels Lagoon) 179
Murrayview 184
Noora 189
Ramco Lagoon 194
Renmark Reservoir (Bookmark Creek) 198
Rufus River 203
Stockyard Plain (Woolpunda) 209

New South Wales

Fletcher's Lake 215
Holland Lakes 1 and 2 221
Holland Lake 3 226
Holland Lake 4 231
Mallee Cliffs 236
Mirrool Farm 196 242
Mirrool Farm 1061 248
Mirrool Farm 1068 (Fitzsimmons) 254
Mirrool Farm1393 (Bilbul) 260
Mirrool Farm 1810 (Sergei) 265
Mourquong Swamp 270
Nulla Discharge Complex 276
Scotia Lakes Discharge Complex 280
Wakool 284

Volume 2

Victoria

Boonoonar..... 290
Bothroyd Dick..... 296
Brickworks Billabong..... 302
Bullock Swamp..... 308
Carwarp 314
Castles Crossing..... 320
Coars Swamp..... 326
Colignan..... 332
Collett..... 338
Commercial Vehicles Ltd..... 345
Cowanna Billabong..... 348
Dow Avenue Woodlots..... 354
Dry Lake..... 359
FMIT 1..... 365
FMIT 2..... 371
FMIT 3..... 376
FMIT 4..... 381
FMIT 5..... 387
FMIT 6..... 392
FMIT 7a..... 397
FMIT 7b..... 403
FMIT 7c..... 408
FMIT 7d..... 413
FMIT 8..... 419
FMIT 9..... 424
FMIT 10..... 429
FMIT 11..... 434
Forbes 66..... 439
Forbes 67..... 444
Frankel/MPI..... 449
Girgarre..... 452
Gunbower..... 458
Hall/Dyson..... 463
Hards..... 468
Jacksons-Mat..... 473
John..... 479
Karadoc Swamp..... 485
Kentias..... 492
Lake Batyo Catyo..... 499
Lake Hawthorn..... 503
Lake Iraak..... 510
Lake Kelly..... 516
Lake Little..... 522
Lake Ranfurly East..... 527

Lake Ranfurly West..... 533
Lake Tutchewop..... 539
Lake William..... 546
Lamberts Swamp..... 552
Lindsay Point..... 558
Margooya Lagoon..... 564
Martin..... 570
McEwans..... 573
Mercer Street..... 580
Mincha West..... 585
Mineral Reserve Basin..... 592
Nangiloc-Colignan..... 598
Nyah..... 603
Old Dam..... 608
Psyche Bend Lagoon..... 614
Robinvale East..... 620
Robinvale West..... 626
RWC 1..... 632
RWC 4..... 637
RWC 5..... 642
RWC 6..... 648
RWC 7..... 653
RWC 8..... 658
RWC 9..... 663
RWC 12..... 668
RWC 13..... 674
RWC 14..... 679
RWC 15..... 684
RWC 16..... 687
RWC 17..... 694
RWC 18..... 699
RWC A..... 704
RWC B..... 709
RWC C, D, E..... 714
RWC Southeast..... 719
Sandilong Park..... 725
Smith..... 730
Smiths..... 733
Sunncliffs/Minters..... 739
Sutherlands..... 744
Tresco Golf Club..... 749
Tresco Kunat Kunat..... 754
Tresco Long Lake..... 759
Tresco Round Lake..... 764
Vartuli/Musgrove..... 769
Wakefield..... 774

Wargan Basin 1 777
Wargan Basin 2 783
Wargan Basin 3 789
Wargan Basin 4 795
Wargan Basin 4a 801
Wargan Basin 5 806
Woorinen Holloways 812
Woorinen Murrawee 818
Woorinen North 824
Woorinen South 830
Wrens Swamp 836
Yatpool 841

Introduction

A concerted and combined effort is being made by the Murray Darling Basin Commission and the relevant state water authorities through the Salt interception Working Group, to prevent or limit salt accession to the River and its tributaries. Saline water is a widespread threat from several sources; from natural and induced groundwater discharge, surface runoff from salinized areas, and from outfall from subsurface drainage of irrigated lands. There are a variety of means of holding and disposing of the saline outfall. Engineering & Water Supply (1994) identify seven methods of disposal. Basins are the most widely used means for disposal of saline water, and include closed system basins receiving piped irrigation drainage waters or water from interception schemes, and backwaters receiving piped irrigation drainage waters. Closed system basins can be natural depressions, modified natural depressions, or completely engineered structures. Terminal basins rely on either or both evaporation and leakage to dispose of the outfall waters.

There are currently more than 150 disposal basins throughout the Murray Basin, from Griffith down to Waikerie (Figure 1). Most basins are adjacent to the Murray River, within or beyond the floodplain in the regions of Waikerie, Barmera, Berri, Noora, Renmark, Lake Victoria, Coomealla-Buronga, Mildura, Nangiloc-Colignan, Robinvale, Swan Hill, Kerang, Cohuna, and Griffith (Figures 2 to 15). Two natural salinas of the mallee, Nulla Spring Lake and the Scotia Lakes are included in the inventory because they offer understanding of the two end-member types of natural salinas that are commonly used as disposal basins in the Mallee region.

Features of the Inventory

The inventory documents all known disposal basins in the Murray Basin. This record comprises two volumes with alphabetic entries for each of South Australia, New South Wales, and Victoria.
It is primarily text-based in a standardised format, with an emphasis on all relevant information and sources concerning any individual basin. Conflicting information is sometimes presented, as well temporal variations in some attributes like outfall salinities etc. It presents the breadth of information from all known sources. Only in the interpretive fields is conflicting information assessed for an interpretation.
The document has drawn from and overlaps with individual state inventories and databases.
Included are all parameters identified by Evans (1989) as essential for disposal basin design, and therefore applicable for an assessment of sustainability.

This inventory is presently being transferred into a relational database for more effective user interaction on a GIS-based system for the MDBC. Additional fields are being added to improve the interrogation facility, but without loss of accuracy in these fields. However, the associated text-based fields will be available for qualification of any generalisations made. Both inventory and database are working documents, to be periodically upgraded as we expect users to respond with additional or corrected information.

Information on each disposal basin includes:

a text file of synonyms of basin name, location and coordinates, operational history, spatial attributes, salinities and water volumes, engineering/administrative information, hydrogeological context, hydrodynamic summary, interpretive aspects of hydraulic linkage to aquifer and to surface runoff, and references cited;

lithostratigraphic cross-sections; and

basin locations as sketch maps and/or annotated airphoto imagery. The photoimages are at the same 1:42 100 scale, and have been digitally enhanced using *Adobe Photoshop 3* for highlighting basin features.

Lithostratigraphic Cross-sections

Cross-sections have been developed from drillers logs of the state water authorities, and with our interpretation for formations and lithofacies. While every effort has been taken to include all known available information with the logs, the stratigraphic interpretation can be tenuous.
The cross-sections are presented with high vertical exaggeration to illustrate lithostratigraphic variations. These sections are not presented at natural scale, but in contrast to the exaggerated V/H, the sequence approximates parallel stratiform units. Borehole and section locations are given in the location image on each section. Borehole elevations and position (AMG) are also given in Appendix 1 . A reference for lithological symbols used in the logs is available in Figure 16.

Context and application of the inventory

There is an urgent need for evaluation of the sustainability of all disposal basins, but it is generally recognized that currently there is a paucity of information for any meaningful comparative overview. This information deficit will be evident from the inventory and existing state databases. The draft criteria and evaluation procedure of Hoxley (1993) were developed to offer a ranking of basins to prioritize further work to reduce the data/ information deficit.

This inventory has been compiled as the most comprehensive basinwide information source on disposal basins. It includes all information categories considered necessary for an evaluation of sustainability and

as such specifically identifies the information deficits. As this deficit is reduced, the standardized format of the inventory will help to streamline the evaluation procedure.

A summary of disposal basins (Radke & Hostetler, in prep.) will offer historical, and regional perspectives, as well as comparisons of existing basins. Completion of this summary awaits statistics to be derived from the relational database.

Acknowledgements

This inventory of saline water disposal basins within the Murray Basin has resulted from a component activity of NRMS Project No. M4042, *Managing disposal basins to maximise their usefulness for salt storage*.

We thank all the people who kindly provided time and effort in supplying information for this project: Geoff Linke, Greg Hoxley, Tony Pascevicius, Henry Chaplin, Anthony Brinkley, Andrew Harrison, Genevieve Foley, Bruce Gill, Lance van der Mudgeway, Charles Thompson, Roger Ebsary, Scott Lawson, Les Ellis, Ari Narayen, David Hoey, Kapila Bogoda, Butch Percival, Roger Oxley, Mike Williams, John Ross, Bill Currans, Mike Erny, Les Kollmorgen, Bob Newman, Ross Stockdale, Bruce Weir, Ken Smith, Mark Stoeckel, Steve Barnett, Ed Collingham, Nick Watkins, Andrew Telfer, Ray Evans, Jim Ferguson, and Janice Kelly.

References

Aberfoyle Resources Ltd., 1989- Final report, Murray Basin, Lake Tandou area, New South Wales. Department of Minerals and Energy Unpublished report (GS 1989/288), 11 pp.

Aberfoyle Resources Ltd., 1989- Final report, Murray Basin, Lake Tandou area, New South Wales Department of Minerals and Energy Unpublished report (GS 1989/282), 11 pp.

Alaouze, C.M., and Fitzpatrick, C.R., 1987- A mixed integer linear programming snapshot model of the Murray Darling Basin salinity problem, Victoria Department of Water Resources Staff paper 09/87, 27 p.

Barling. R., and Linke, G., 1993- Nangiloc Colignan Salinity Management Plan Technical note on lake Iraak and Doerings Basin., Rural Water Corporation, Unpublished technical note

Barnett, S.R., 1992- Regional hydrogeology of the Loxton-Noora area, Murray basin, South Australia., South Australia Department of Mines and Energy, Geological Survey, Report Book 92/15, 6 p.

Barnett, S.R. (South Australia Department of Mines and Energy), 1991- Renmark Hydrogeologic Map (1:250 000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia

Barnett, S.R., 1983- Murray Basin Hydrogeological Investigation, Data Assessment - Mallee Region., South Australia Department of Mines and Energy Report Book (RB 83/18).

Barnewall, K., and Brinkley, A., 1992- Lake Tutchewop Disposal Complex hydrogeological and groundwater monitoring review, Unpublished report number 1992/ , Rural Water Commission, 14 pp.

Barratt, J.R., Jacobs, T.A., and Cresswell, D.J., 1984- River Murray Resources Planning Study: Phase II: Proposed salinity mitigation scheme: Progress report on preliminary assessments, Ref no. 403W:51W, 14 p.

Beale, P., and Moore, S., 1993- Wakool Land and Water management Plan: District summary., NSW Agriculture,96 p.

Beckwith, N.R., 1979- Rehabilitation of Berri-Cobdogla Drainage Scheme: River Murray Salinity Control: Pipe materials and concrete, South Australia Engineering and Water Supply, EWS 849/79

Bish, S., and Williams, R.M., 1992- Mallee Cliffs Salt Interception Scheme: Installation of production bores and review of hydrogeological conditions., Department of water Resources Technical Services Division, TS 92/042, 40 p.

Blackmore, D., 1988- Chowilla Salinity Mitigation Scheme: summary of draft environmental impact statement, Community Conference on the Hydrogeology of the Sunraysia Region, Rural Water Commission of Victoria, 32-39

Bluml, M., 1992- Sunraysia Salinity management Plan Environment report., Dept of Conservation and Environment, ISBN 0 7306 2715 2, 103 p.

Bowler, J.M., and Macumber, P.G., 1973- The Riverine Plain in northern Victoria., in McAndrew, J., and Marsden, M.A.H. (eds), 1973, Regional Guide to Victorian Geology., School of Geology, University of Melbourne, p. 213-224

Brodie, R., (AGSO), 1992- ANA BRANCH Hydrogeological Map (1:250 000 scale). Australian Geological Survey Organisation, Canberra, Australia.

Bromfield, W.E., 1953- Woorinen South Drainage., State River and Water Supply Commission, Unpublished report

Brown, C.M., 1991- Unpublished Field Notes

Brown, C.M., 1989- Structural and stratigraphic framework of groundwater occurrence and surface discharge in the Murray Basin, southeastern Australia, J. Aust. Geology and Geophysics., v. 11, p. 127-143

Brown, C.M., and Stephenson, A.E., 1991- Geology of the Murray Basin, Southeastern Australia., Bureau of Mineral Resources, Geology and Geophysics, BMR Bulletin 235, (Australian Government Publishing Services, Canberra)

Brown, C.M., and Stephenson, A.E., 1986- Murray Basin, Southeastern Australia: Subsurface Stratigraphic database. BMR, Geology and Geophysics, Report 262 (Australian Government Publishing Services: Canberra)

Budahazy, M., and Thompson, M., 1992- Nangiloc-Colignan Salinity Management Plan Investigation of basins for use as drainage disposal basins., Rural Water Corporation, Unpublished report 1992/15

Buonaiuto, M.F. (CRA Exploration Pty Ltd), 1980- Langhorne Sub-basin, north west Padthaway Archipelago, South Australia, Late Eocene - Pliocene Stratigraphy, South Australia Department of Mines and Energy Unpublished report (E3729,), fiche nos. 1,2,18-21, p 11-82

Caldwell Connell Engineers Pty. Ltd., 1984- Salt harvesting at the mineral reserve basins, Unpublished report, State Rivers and Water Supply Commission of Victoria, 18 pp.

Caldwell Connell Engineers Pty ltd, 1981- Katarapko Island evaporation basin environmental study., South Australia Engineering and Water Supply Department 1981-04, 70 p.

Chambers, L.A., Williams, B.G., Barnes, C.J., and Wasson, R.J., 1992- The effect of irrigation waste-water disposal in a former discharge zone of the Murray Basin, Australia, Journal of Hydrology, v. 136, p. 303-332

Clarke, D.C., 1992- Waikerie Saline Groundwater Interception Scheme drilling and discharge testing general report., South Australia Department of Mines and Energy, Report Book 92/63.

Coffey and Partners Pty Ltd, 1988- Waikerie Salinity Mitigation Study., South Australia Engineering and Water Supply,

Coffey and Partners Pty Ltd, 1982- Hydrogeological study of the Mineral Reserve Basin Scheme., for State Rivers and Water Supply Commission, Report H81/1-AA

Cole, P.J., van der Sommen, F., and Smith K.G., 1974- Environment Impact Study Katarapko Island Evaporation Basin., Soil Conservation Branch, South Australia Department of Agriculture, S8/74.

Collingham, E.B., 1991- Cooltong Drainage Disposal Basin: A study of its hydrogeologic performance and impact on Ral Ral Creek., South Australia Engineering and Water Supply Engineering Services Branch, unpublished.

Collingham, E.B., 1990- Chowilla hydrogeological studies by the Engineering and Water Supply Department South Australia: Technical discussion papers. Civil Section Engineering Services Group Engineering and Water Supply Department, South Australia, EWS unregistered.

Collingham, E.B., 1989- Katarapko Island Evaporation Basin - Loxton Irrigation Area: Summary of hydrogeology., South Australia Engineering and Water Supply, unpublished.

Collingham, E.B., 1971a- Bulyong Island Report., South Australia Engineering and Water Supply Soils and Foundations., Unpublished, EWS 6504/71, 9 p.

Collingham, E.B., 1971b- Dishers Creek Evaporation Basin., South Australia Engineering and Water Supply Department, EWS 6505/71, 2 p., unpublished

Collingham, E.B., 1969- Cadell Evaporation Basin., South Australia Engineering and Water Supply Department, Unpublished report 991/69

Collingham, E.B., and Newman, R.J., 1986- Woolpunda Groundwater Interception Scheme: Geotechnical report for disposal to a basin at site Y, South Australia Engineering and Water Supply, EWS 86/55.

Collingham, E.B., and Newman, R.J., 1982- Rufus River Saline Groundwater Interception Scheme: Proposed Evaporation Basin Site 'A': Soil report and design summary, South Australia Engineering and Water Supply, EWS 82/20, 10 p

Cox, F., 1989- Mildura-Merbein Groundwater Interception Scheme north of Lake Ranfurly redesign of pumping bores., Rural Water Corporation Unpublished report 1989/28

Dames and Moore, 1989- Mallee Cliffs Interception Project Draft Environmental Impact Statement., Department of Water Resources, 14213.004, 68 p.

Dames and Moore, 1989b- Mallee Cliffs Salt Interception Scheme Preliminary Design Report. Department of Water Resources, 14213.004.070, 75 p.

Dames and Moore, 1988- Mallee Cliffs Salt Interceptions Project preparation of environmental impact statement stage 1a site assessment report, Department of Water Resources, 14213-03

Dames and Moore Consultants, 1987- Mallee Cliffs-Lambert Island Salinity Investigation Project: Phase 2 Disposal Site Investigation. Unpublished report to Murray-Darling Basin Committee.

Department of Water Resources (DWR) (New South Wales), 1988- Report on stratigraphy and subsurface hydrology of the Wakool-Tullakool Salinity Sub-Surface Drainage Stage 2 Evaporation Basin.,

Dinos, Alexandra, 1992- Lake Tutchewop investigation of possible salinisation to neighbouring region by Lake Tutchewop, Rural Water Corporation, Technical Services, Technical Report No. 1992/TN/71/92, 68 pp.

Dudding, M., 1990- Lindsay River Salinity Assessment Progress Report No. 2., Rural Water Corporation, Unpublished report 1990/57.

Dudding, M., Oakes, A., and Thorne, R., 1989- Lindsay River Salinity Assessment Report., Rural Water Corporation, Unpublished report 1989/23.

Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

Emerson, W.W., 1967- An investigation of Tilmy Flat as an evaporating basin for saline water. Infiltration studies and hydraulic conductivity measurements., South Australia Department of Mines and Energy Unpublished report E6803

Engineering and Water Supply Department (E&WS) (South Australia), 1994 - Evaluation of Saline Water Disposal Basins along the River Murray between Lock1 and Lake Victoria. EWS 94/1

Engineering and Water Supply Department (E&WS) (South Australia), 1992- Woolpunda Salt Interception Scheme report no. 1, July 1990-June 1991, EWS 91/25

Engineering and Water Supply Department (E&WS) (South Australia), 1991- Waikerie Salinity Interception Scheme pump test reports for WIB 2 and WAIK 9, unpublished.

Engineering and Water Supply (E&WS) (South Australia), 1989a- Enhancing wetlands., South Australian River Murray Wetlands Working Party Report, Engineering and Water Supply Department and Department of Environment and Planning, EWS 1439/88, Report no. 88/7, 174 p.

Engineering and Water Supply Department (E&WS) (South Australia), 1989b- Noora drainage disposal scheme. Noora basin groundwater observations. E&WS, Annual report no. 7, Library Reference 89/19

Engineering and Water Supply Department (E&WS) (South Australia), 1989c- Visit to Disher Creek Evaporation Basin in South Australia: Visit by the Hon. Bob Hawke, AC, MP Prime Minister of Australia, July 20, 1989., EWS

Engineering and Water Supply Department (E&WS) (South Australia), 1989d- Noora Drainage Disposal Scheme: Noora Basin Groundwater Observations, Annual Report No. 7., EWS 89/19, 3 p.

Engineering and Water Supply Department (E&WS) (South Australia), 1988- Noora Drainage Disposal Scheme: Noora Basin Groundwater Observations, Annual Report No. 6., EWS 88/40, 3 p.

Engineering and Water Supply Department (E&WS) (South Australia), 1985- River Murray water resources: Planning study phase II: Chowilla Area., EWS 730/1984.

Engineering and Water Supply Department (E&WS) (South Australia), 1983- Chaffey Irrigation Area: Review of rehabilitation scheme for irrigation headworks., EWS 82/46.

Engineering and Water Supply Department (E&WS) (South Australia), 1982a- Rufus River saline groundwater interception scheme proposed evaporation basin "site A' soil report and design summary., South Australia Engineering and Water Supply Department 1982-03, 10 p.

Engineering and Water Supply Department (E&WS) (South Australia), 1982b- Moorook Irrigation Area revised rehabilitation of irrigation scheme, Riverland region., EWS 82/49, 30 p.

Engineering and Water Supply Department (E&WS) (South Australia), 1979- The Rufus River groundwater interception scheme., South Australia Engineering and Water Supply Department Report 79/29, 35 pp.

Engineering and Water Supply Department (E&WS) (South Australia), 1974- Kingston Irrigation Area-Pumping Scheme: Information for operators., EWS 5776/73

Evans, R.S., 1989 - Saline water disposal options in the Murray Basin. BMR Journal of Australian Geology & Geophysics, 11, p. 167 -185.

Ferguson, J., 1993- Hydrodynamics of the Lake Tutchewop salt disposal complex, Murray Basin, Preliminary Report on AGSO Investigations, 6 pp.

Firman, J.B., 1973- Regional stratigraphy of surficial deposits in the Murray basin and Gambier Embayment., South Australia Geological Survey, Report of Investigations no. 39 (RB 71/1), 68 pp.

Firman, J.B., 1972- Renmark, South Australia - 1:250 000 Geological Series., Geological Survey of South Australia, Explanatory notes, SI/54-10.

Foley, G., 1992- Salinity traverse of the Murray River: Euston Weir to Wemen Results of the March and May 1991 traverses., Rural Water Corporation, Unpublished report TN 49

Gato, S. and Budahazy, M., 1992- Sunraysia salinity management plan: Lake Hawthorne scheme: alternate operational criteria., Rural Water Commission of Victoria report no. 1992/10

Harrison, A., in prep, Lake Tutchewop hydrogeological investigation., Rural Water Corporation (Hydrotechnology), Unpublished report

Howles, S.R., 1986- Berri east groundwater interception scheme: hydrogeological investigation., South Australia Department of Mines and Energy Unpublished report (RB 86/059, October,). 5 fiche, 122 pp.

Hoxley, G., 1993- Criteria for the evaluation of disposal basins. Rural Water Corporation (Draft for discussion purposes) TN/86/93

Hoxley, G., 1991- Hydrogeological summary of wetland areas in the Sunraysia Salinity Management Plan Area., Rural Water Corporation, Groundwater Section, Technical note 1

Hoxley, G., 1990- The hydrogeological framework of the Sunraysia Sub-regional Salinity Management Plan., Rural Water Corporation, Unpublished report 1990/59

Hoxley, G., Ife, D., and Pratt, M., 1989- Kerang Lakes Area hydrogeological assessment., Rural Water Corporation, Draft report

Ife, D., 1988- Hydrogeological mapping of the Upper Shepparton Formation, Shepparton Region., Rural Water Commission of Victoria, Report No. 1988/29., 41 p.

Ife, D., 1985- Hydrogeology of the Mineral Reserve Basins., Rural Water Commission, Unpublished report.

Ife, D., 1984- Salinisation and groundwater studies in the Shepparton Region., Unpublished M.App.Sc. thesis, University of NSW

Jacobs, T., and Collingham, E.B., 1984- River Murray Phase II Studies: Berri East Groundwater Interception Scheme: Summary report., South Australia Engineering and Water Supply, EWS 730/84.

Jacobson, G., and Ferguson, J., 1992- Salt lake dynamics, wastewater disposal, and evaporation basins., Australian Geological Survey Organisation. Research Newsletter, no. 19, p. 12-13

Jensen, A., 1983- Lake Merreti: an environmental baseline study 1983., Assessments Branch, South Australia Department of Environment and Planning, SADEP 61

Jolly, I.D., McEwan, K.L., Holub, A.N., Walker, G.R., Dighton, J.C., and Thorburn, P.J., 1992-Compilation of groundwater data from the Chowilla Anabranch Region, South Australia., CSIRO Technical Memorandum 92/9, Division of Water Resources

Kernich, A.M., 1984- The climate of the River Murray and environs, South Australia., Technical report, South Australia Department of Agriculture.

Killick J.C., 1973- Interim report on salinity control in the Lake Victoria area., South Australia Engineering and Water Supply Department Report 1973/2

Killick J.C., and Allen, C.M., 1973- Dishers Creek Basin: technical report., South Australia Engineering and Water Supply Department Report 73/16, 13 p.

Kinhill Engineers, 1987a- Woolpunda groundwater interception scheme: draft environmental impact statement., South Australia Engineering and Water Supply Department., 60 p.

Kinhill Engineers, 1987b- Woolpunda groundwater interception scheme: supplement to the draft environmental impact statement., South Australia Engineering and Water Supply Department, 1987-11

Kinnaird, Hill, DeRohan, and Young, Pty. Ltd., 1979- Salt disposal at Noora. A Report to the South Australian Engineering and Water Supply Department (unpbl.). 173 pp.

Lawrence, C.R., 1991- Preliminary hydrogeological analysis of sensitive areas of the Murray River Trench - Sunraysia., Office of Water Resources, Victoria, Unpublished report

Lawrence, C.R., 1975- Geology, hydrodynamics, and hydrochemistry of the southern Murray Basin. Geological Survey of Victoria, Memoir 30

Lawrence, C.R., 1973- Mildura 1:250,000 Geological Map., Mines Department of Victoria, Number 1973/3

Lawrence, C.R., 1967- Geology and groundwater resources of the Little Desert, western Victoria, Victorian Department of Minerals and Energy, Unpublished report (1967/024), 21 pp.

Lawrence, C.R., 1966- Hydrogeology of deposits of a prior Goulburn distributary extending from Toolamba to Echuca., Victoria Department of minerals and Energy Unpublished report (1966/040), 3 pp.

Lawrence, C.R., and Macumber, P.G., 1974- Geology of part of Balranald and Deniliquin (1:250,000 scale)., Geological Survey of Victoria

Lawrence, C.R., and Macumber, P.G., 1974- Swan Hill Geological Map (1:250,000 scale)., Geological Survey of Victoria

Lindsay, J.M., 1977- Loxton Sands exposure, Peake area, Murray Basin, South Australia Department of Mines and Energy Unpublished report (RB 77/146, December,), 4 pp.

Linke, G., 1994a- Nangiloc-Colignan SMP - Ian Forbes Basin - Evaporation capacity - CMS Comps., Unpublished working file No. 02/00875

Linke, G., 1994b- Nangiloc-Colignan McEwans, Kentia, and Colletts Basins - Evaporation capacity., Unpublished working file No. 02/00859

Linke, G., 1993- Nangiloc Colignan SMP - Drainage disposal to Karadoc Swamp - CMS Comps., Rural Water Corporation, Unpublished working file No. 93/01895

Linke, G., 1990a- Sunraysia Region Drainage Disposal to the Murray River drain flow, salinities and salt loads., Rural Water Corporation, Unpublished report 1989/22

Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Linke, G.K., 1989- Carwarp Channel seepage effects on Murray River (Nangiloc Colignan Salinity Management Plan)., Rural Water Corporation Investigation Branch, Unpublished report 89/34

Linke, G.K., 1988- Summary paper on upgrading of the Mildura-Merbein Groundwater Interception Scheme., Community Conference on the Hydrogeology of the Sunraysia Region, Rural Water Commission of Victoria, p. 27-31

Linke, G.K. and Bailey, 1992- Potential for Groundwater Interception at Goodnight - A River Murray Salinity Assessment, Rural Water Commission of Victoria, 1992/18

Linke, G.K., Gato, S., and Northey, P., 1991a- Evaluation of drainage disposal options for Red Cliffs: background report for Sunraysia Salinity Management Plan., Rural Water Commission of Victoria Report no. 1991/24

Linke, G.K., Gato, S., and Northey, P., 1991b- Evaluation of drainage disposal options for Merbein., Rural Water Commission of Victoria Report 1991/25

Linke, G., and Ryan, S., 1988- Lake Batyo Catyo Salinity Investigation: Technical report., Rural Water Corporation, Unpublished report 1988/11

Linke, G., and Samarasinghe, N., 1993- Doerings Evaporation Basin Investigation. Nangiloc-Colignan Salinity Management Implementation., Rural Water Corporation, Unpublished report

Little B.J., 1982- River Murray salinity control programme, Noora drainage disposal scheme, Bulyong Island Basin, rising main investigation., South Australia Engineering and Water Supply Department 1982-09, 22 p.

Lloyd, L., Moller, J., and Balla, S., 1984- Berri evaporation basin study, Unpublished, University of Adelaide, Department of Zoology.

Macumber, P.G., 1983- Interactions between groundwater and surface systems in Northern Victoria, Unpublished PhD Thesis, Department of Geology, University of Melbourne.

McConachy, F., 1991- Design of an evaporation basin and tile drainage demonstration site on the Tragowel Plains., Rural Water Corporation, Unpublished report

Meacham, I., 1974- Kerang Region Salinity Investigations. Progress report January-December 1974., State River and Water Supply Commission, Unpublished report

Micke, S., 1994- Renmark Reservoir Salinty Control Scheme Operational Performance Review, SA Engineering and Water Supply, Unpublished

Ministry for Planning and Environment Loddon-Campese/Mallee Region, 1989- Kerang Rural Land Mapping Project.

Morias, A., 1982- Report on public comments on Katarapko Island evaporation basin environmental study., South Australia Engineering and Water Supply Department 82/43, 13 p.

Murray Darling Basin Commission (MDBC), 1992- Chowilla Resource Management Plan Progress Report, Murray Darling Basin Commission's Chowilla Working Group and Chowilla Reference Group, 33 p.

Narayan, K., and Armstrong, D., 1993- Simulation of groundwater interception at Lake Ranfurly, Victoria, incorporating variable density flow and solute transport., Centre for Groundwater Studies, Report 52

National Environmental Consultancy, 1987- Chowilla Salinity Mitigation Scheme: Draft Environmental Impact Statement, South Australia Engineering and Water Supply,

Olshina, A., 1988- Shepparton Formation watertable maps and deep lead potentiometric surface maps., Victoria Department of Industry Technology and Resources Unpublished report (1988/28)

O'Rourke, M.E., et. al, Victorian Rural Water Commission, 1992- Swan Hill Hydrogeological Map (1:250,000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra Australia

Overton, W., 1993- Groundwater conditions Berriquin, Wakool, Deniboota, and Denimein Irrigation Districts to Feb 1993, Department of Water Resources, Murray Region

Paskevicius, A., 1993- Evaporation disposal basins in the Victorian portion of the Murray Basin, Technical Note number TN/111/93, Catchment Management Group, Rural Water Commission, Draft, Unpublished, 38 pp.

Peregrine Resources (Australia) NL.; Aerodata Holdings Ltd., 1989- Alexandrina, Bungunnia and Quondong Vale. Progress and final reports form 2/9/88 to 1/3/89, South Australia Department of Mines and Energy Company report (E8059,)

Pratt, M.C., 1988- Hydrogeological assessment of the Loddon and Avoca Plains., Department of Water Resources, Victoria, Unpublished report

Prince, S.D., 1991- Investigations on holdings 98,99, and 111 Wakool Irrigation District in accordance with 'out of court' settlement agreement., Department of Water Resources

Poulton, D.C., 1984- The hydrology of an experimental tile drainage system at Kerang 1975-78., State Rivers and Water Supply Commission, Unpublished report

Radke, B. & Hostetler, S., in prep.- Saline water disposal basins of the Murray Basin. AGSO Record

Radke, B.M., 1993- Physiographic and lithostratigraphic interpretation of the Nulla, Mourquong, and Scotia Groundwater Discharge Complexes, Mallee Region, Murray Basin, Southeastern Australia. (Unpbl.). CSIRO-AGSO project;Groundwater dynamics of evaporative brines and their application to saline wastewater disposal.

Ray, H. (NSWGS), 1991?, unpublished- Lake Victoria 1:100 000 preliminary compilation for 1:250 000 Anabranch Surficial Geology.

Reid, M., 1990- Southern Riverine Plains stratigraphic map series., Rural Water Commission of Victoria, Report. 1990/20.

Robinson, M., 1992- Salinity risk assessment of the Victorian Mallee, Southeastern Australia., Rural Water Corporation, Unpublished report 1992/32.

Rogers, P.A., 1978- Chowilla, South Australia - 1:250 000 Geological Series., Geological Survey of South Australia, Explanatory notes, SI/54-6.

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1993b- Hydrographs and E.C. plots for bores in the proximity of evaporation disposal basins, Draft report, Unpublished, 386 pp.

Rural Water Commission, 1993c- Location plans of bores in the proximity of evaporation disposal basin sites, Draft report, Unpublished, 30 pp.

Rural Water Commission, 1992- Eighth and final Annual report. 1st July 1991- 30th June 1992.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Rural Water Commission, 1980- Evidence to the Parliamentary Public Works Committee Inquiry into Salinity Control and Drainage on Nangiloc-Colignan drainage proposals., Victoria State Rivers and Water Supply Commission, 17 p.

Schroo, H., 1988- Mallee Cliffs project overview, Community Conference on the Hydrogeology of the Sunraysia Region, Rural water Commission of Victoria, p. 15-20

Scott, D.C., 1990a- Yamba-Noora gypsum deposits - results of 1989 scout drilling programme, South Australia Department of Mines and Energy Unpublished report (RB 90/061), 55 pp.

Schroo, H., 1988- Katarapko sand deposit, EML 4901, section 82, Hd. Katarapko- KJ and PJ Migga, Department of South Australia Mines and Energy Unpublished report (RB 90/056, September,), 25 pp.

Scott, D.I., Williams, R.M., and Erny, M., 1991- Coomealla Irrigation Area pipeline Proposal: A review of the regional groundwater. Department of Water Resources, Technical Unit, 42 p.

Shepherd, K.J., 1967- Disposal of salt water from Chowilla Dam at Tilmy Flat., South Australia Engineering and Water Supply Department Report 67/8, 17 pp.

Sibenaler, X., 1988- Woolpunda Groundwater Interception Scheme, phase 2: drilling and well discharge testing program: geological survey., South Australia Department of Mines and Energy Report Book (RB 88/16).

Simpson, H.J., and Herczeg, A.L., 1991- Salinity and evaporation in the River Murray Basin, Australia, Journal of Hydrology, v. 124, p. 1-27

Smith, K.G., 1990- Summary report on the trial lowering and refilling of Lake Bonney (Riverland), May-June 1990., South Australia Engineering and Water Supply Department, BR73

Smith, K.G., and Collingham, E.B., 1988- Cooltong Drainage Disposal Basin: Calculation of loss of water by infiltration and evaporation, South Australia Engineering and Water Supply, Unpublished.

Smith, K.G., and Watkins, N., 1993- Border to the Barrages - Natural resource criteria for sustainable irrigation on the River Murray., River Murray Water Resources Committee, 100 p.

Soils and Foundation Section, 1985- Toolunka Irrigation District: Hundred of Markaranka profile drilling and piezometer installation Programme, Ref Dock No. 2573/85

Stace, P., 1990- Lake Bonney lowering and refilling trial May 1989 to June 1990., Technical report. Hydrological activities., South Australia Engineering and Water Supply, BR72

Stadter, F., and Stewart, G., 1991- Border Groundwaters Agreement. Five year groundwater assessment review 1986-1990, Report to Border Groundwaters Agreement Review Committee, South Australia Department of Mines and Energy Unpublished report (RB 91/009, January,), 3 fiche, 27 pp.

State Rivers and Water Supply Commission, Victoria (SR&WSC), 1974- Sunraysia Salinity Investigations., Unpublished report

Telfer, A., 1987- Executive summary: Hydrogeology Woolpunda Groundwater Interception Scheme: Preconstruction investigation and design volume III, South Australia Engineering and Water Supply, EWS 87/42, 34 p

Telfer, A., and Watkins, N., 1991- Waikerie Salt Interception Scheme final design report hydrogeology., South Australia Engineering and Water Supply, EWS 90/14, 51 p.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.

Tickell, S.J., 1983- The deep aquifer, northern Victoria, horizontal groundwater flow and recharge., Victoria Department of Minerals and Energy Unpublished report (1983/042), 9 pp.

Van der Lelij, A., and Erny, M., 1989- Effect of disposal lakes on groundwater conditions, lower Murray Darling Region-Discussion paper, New South Wales Department of Water Resources Technical Report 89/022.

Waterhouse, J., 1989- Salinity mitigation investigations in South Australia: Chowilla the hydrogeology of the Chowilla Floodplain: Status report., Murray Darling Basin Commission, 15 p.

Watkins, N., 1992a- Chowilla Resource Management Plan hydrogeological data report 1: Drilling and laboratory soil testing., South Australia Engineering and Water Supply Department, and Murray Darling Basin Commission., EWS 92/8, 2 p.

Watkins, N., 1992b- Chowilla Resource Management Plan hydrogeological data report 2: Aquifer pump testing and groundwater chemistry., South Australia Engineering and Water Supply Department, and Murray Darling Basin Commission., EWS 92/8, 2 p.

Watkins, N., 1992c- Chowilla Resource Management Plan hydrogeological data report 3: Interpretation of aquifer pump testing., South Australia Engineering and Water Supply Department, and Murray Darling Basin Commission., EWS 92/8, 3 p.

Watkins, N., 1992d- Loxton salinity and drainage investigation status report on hydrogeology., Murray Darling Basin Commission, EWS 92/20, 8 p.

Watkins, N., 1991- Loxton Salinity Mitigation Studies Noora Drainage Disposal Basin regional impact studies: results of a drilling and pump testing programme March-August 1991., South Australia Engineering and Water Supply Department., EWS 91/24, 5 p.

Williams, A.F., 1978- Recharge investigations, northern margin of the Milang Basin; Milang Langhorne Creek area., South Australia, Department of Mines and Energy, Mineral Resources Review 142, p. 7-25

Williams, A.F., 1979- Investigation of potential evaporation basins, Upper Murray, South Australia., Department of Mines, South Australia, Progress Rep. No. 3, Rep. Book No. 76/16, 152 pp.

Williams, A.F., 1976- Investigation of potential evaporation basins, Upper Murray, South Australia., Department of Mines and Energy, South Australia, Progress Rep. No. 3, Rep. Book No. 76/16

Williams, A.F., 1974- Investigation of potential evaporation basins, Upper Murray, South Australia., Department of Mines and Energy, South Australia, Progress Rep. No. 1, Rep. Book No. 74/152, 135 pp.

Williams, R.M., 1993- Evaluation of Disposal Basins by Ranking in New South Wales, Department of Water Resources, Technical Services Division, 26 pp.

Williams, R.M. and Erny, M., 1991- Hydrogeology of the interaction between Pliocene Sand Aquifer and the Darling River Anabranch System., Department of Water Resources Technical Services Division, TS 91/035, 82 p.

Williams, R.M. and Erny, M., 1991- Hydrogeology of the interaction between Pliocene Sand Aquifer and the Darling River Anabranch System., Department of Water Resources Technical Services Division, TS 91/035, 82 p.

Williams, R.M., and Hamilton, S.T., 1990- Mallee Cliffs Salt interception Scheme: Review of hydrogeological conditions., Department of Water Resources Technical Services Division, TS 92/011, 123 p.

Williams, R.M. and Woolley, D. Department of Water Resources, 1992- Deniliquin Hydrogeological Map (1:250 000 scale), Australian Geological Survey Organisation, Canberra, Australia

Woolley, D., (Department of Water Resources, NSW), 1991- Narrandera Hydrogeological Map (1:250,000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Wynn, D.W., 1962- Narrandera- 4 mile Geological Series., The Geological Survey of New South Wales, Sheet I55/10 Zone 7, Australian National Grid.

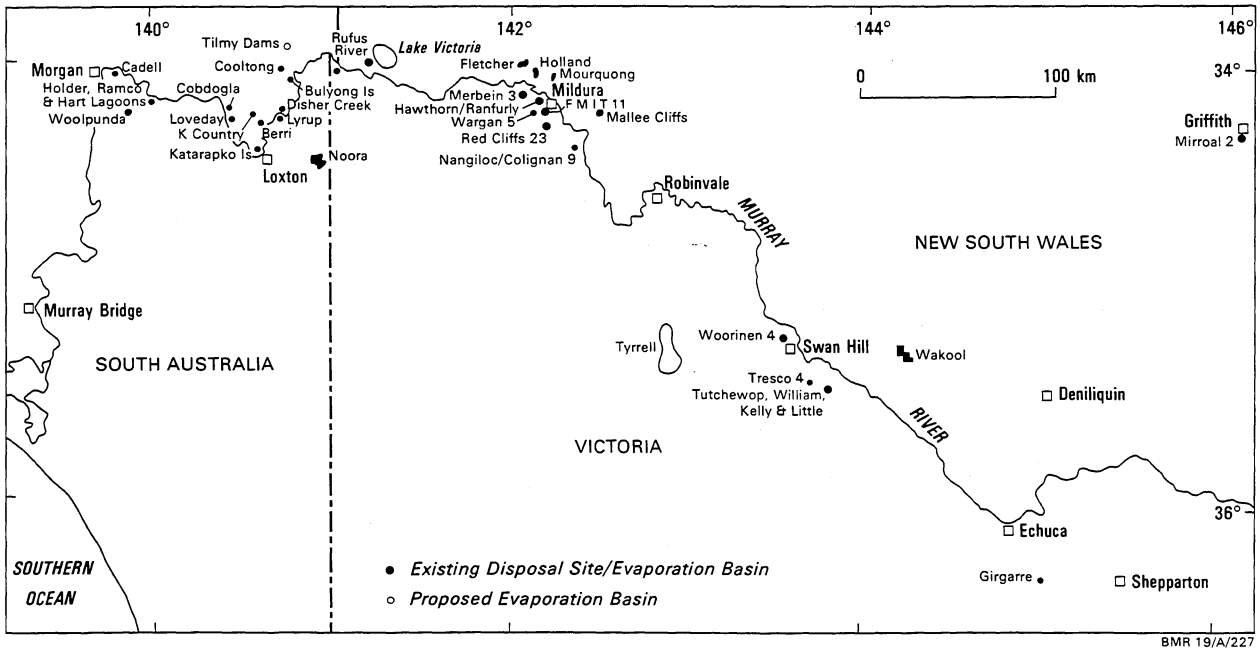


Figure 1 Distribution of saline water disposal basins along the Murray River (after Evans, 1989)

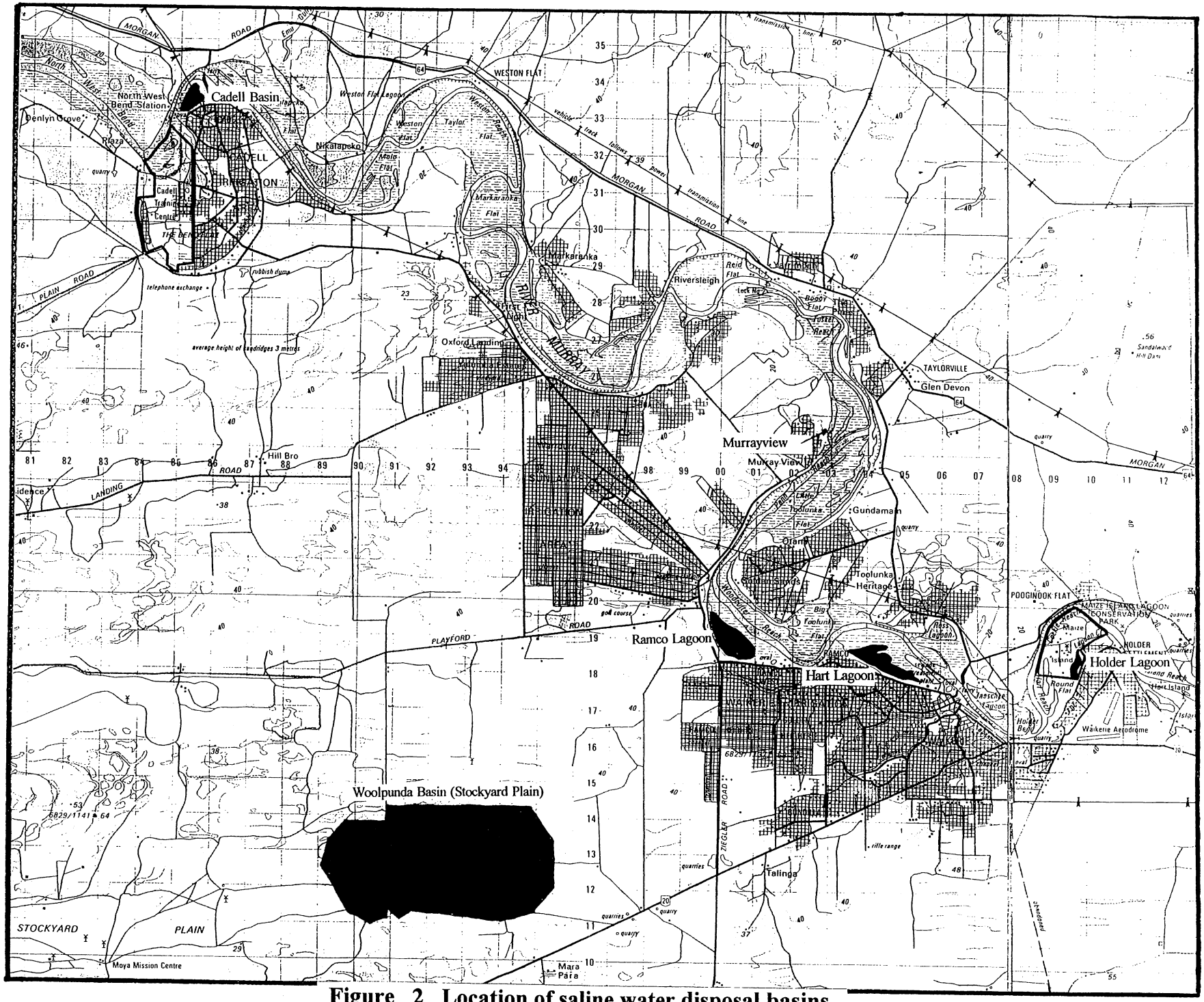


Figure 2 Location of saline water disposal basins, Waikerie district, S.A.

Grid is 1 kilometre square

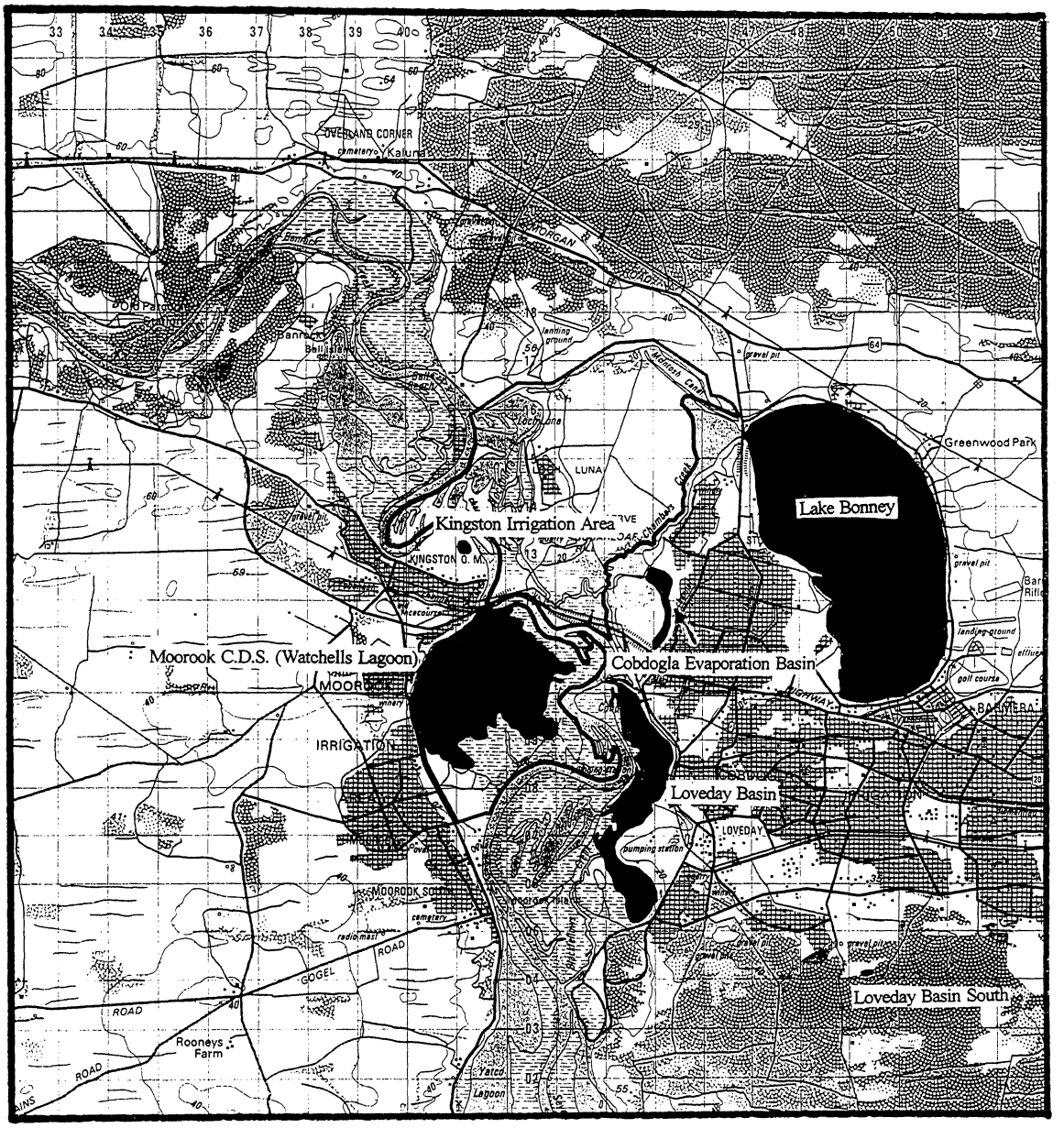
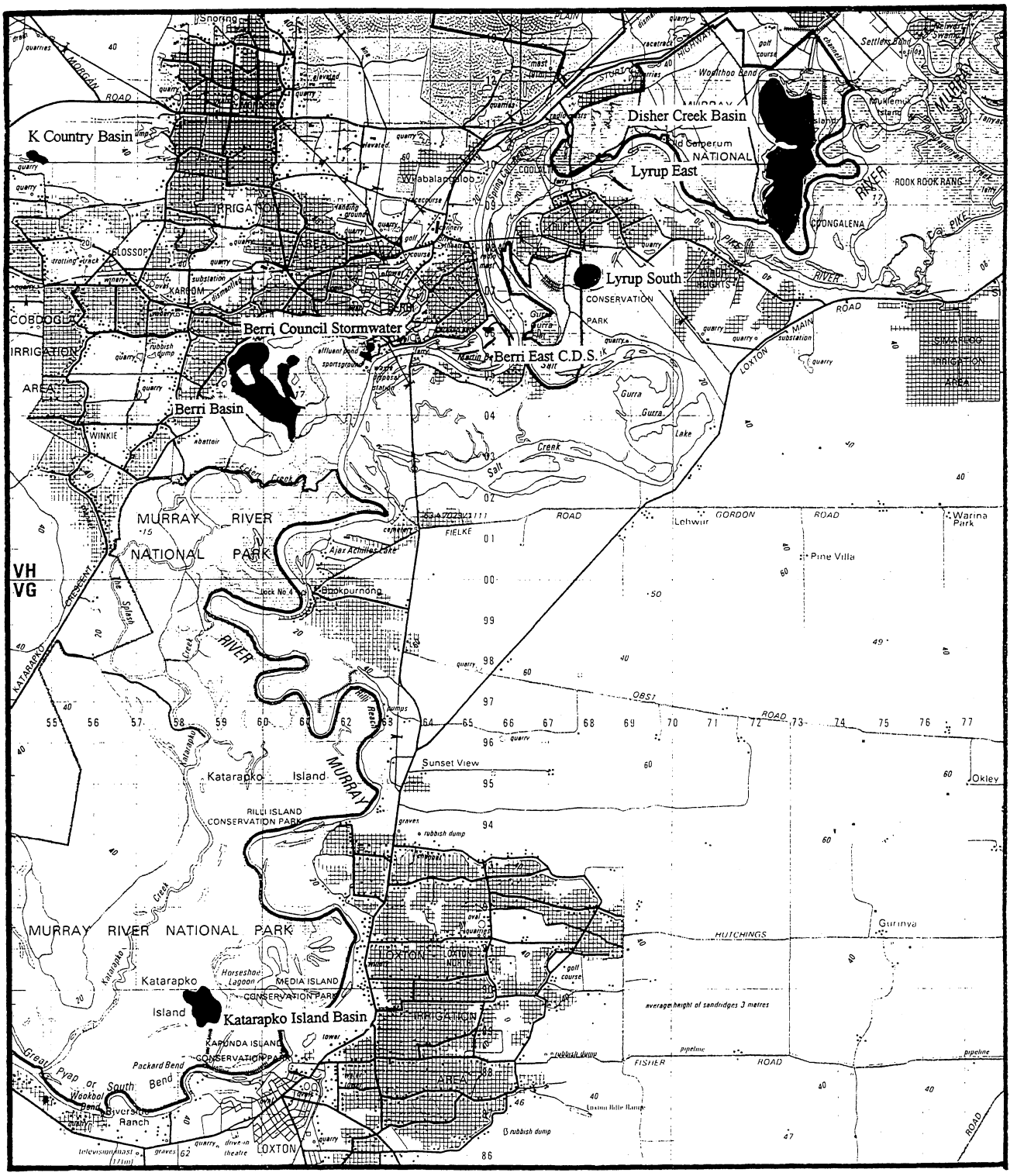


Figure 3 Location of saline water disposal basins, Barmera district, SA



Grid is 1 kilometre square

Figure 4 Location of saline water disposal basins, Berri district, SA.

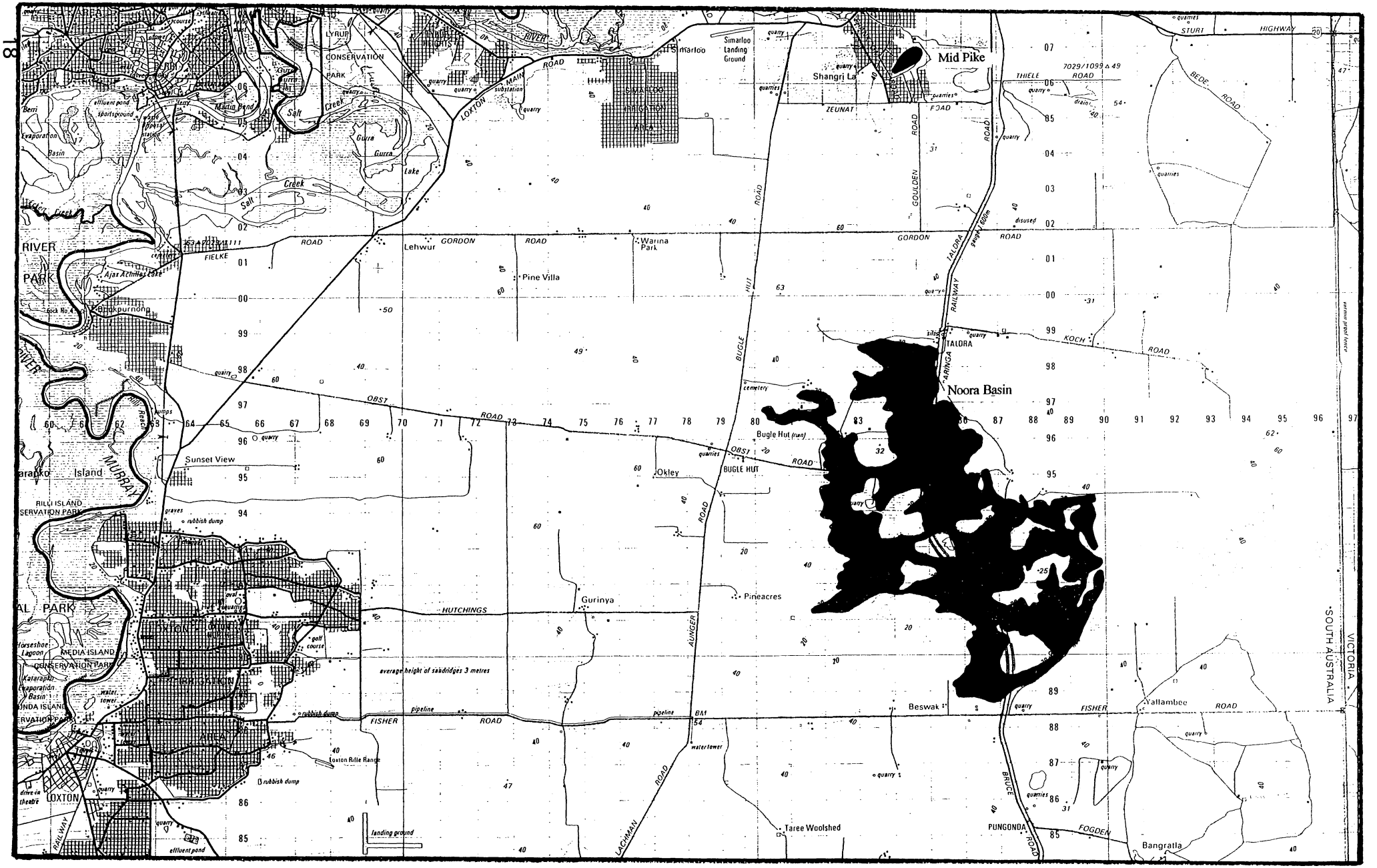


Figure 5 Location of saline water disposal basins, Noora, SA.

Grid is 1 kilometre square

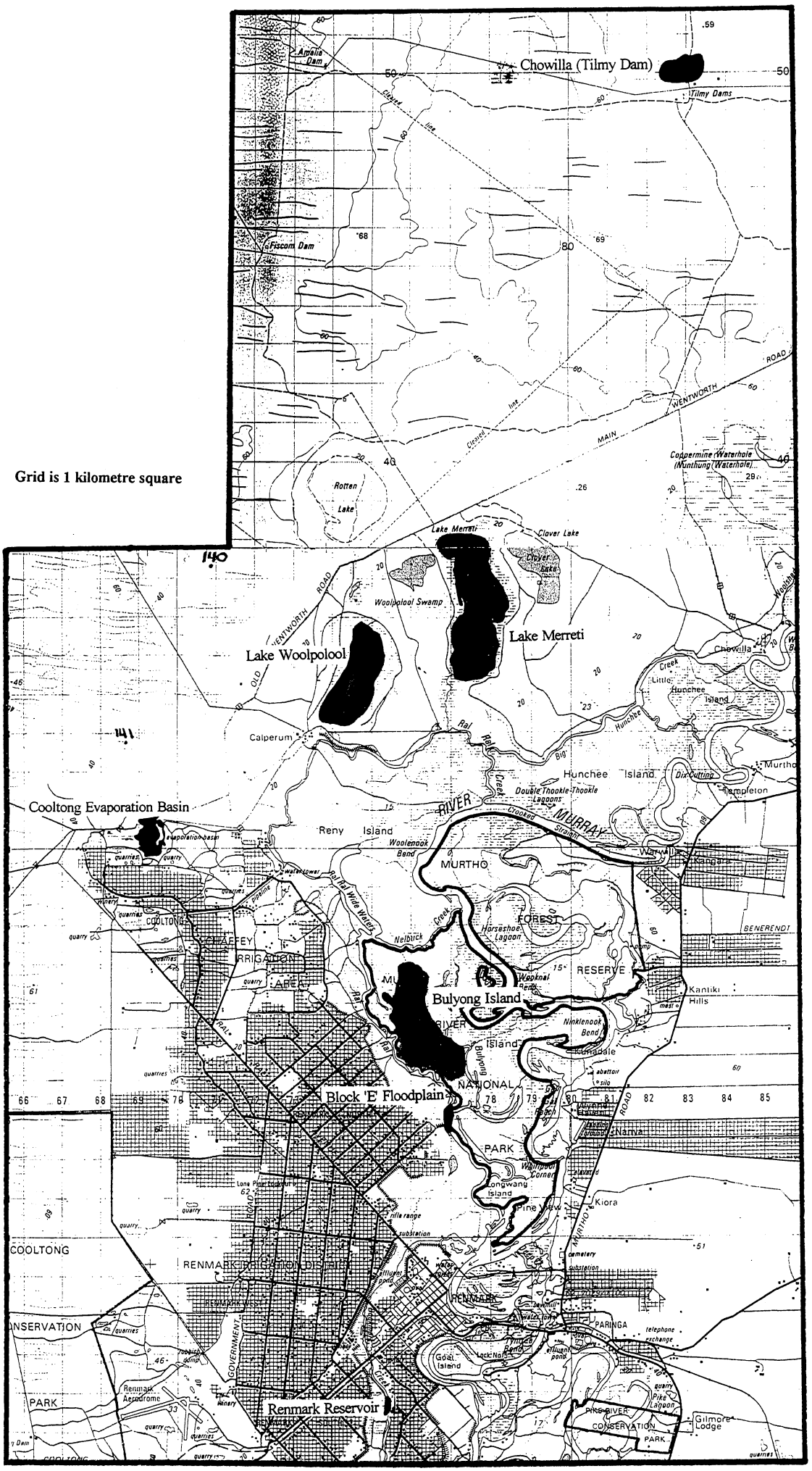


Figure 6 Location of saline water disposal basins, Renmark district, SA.

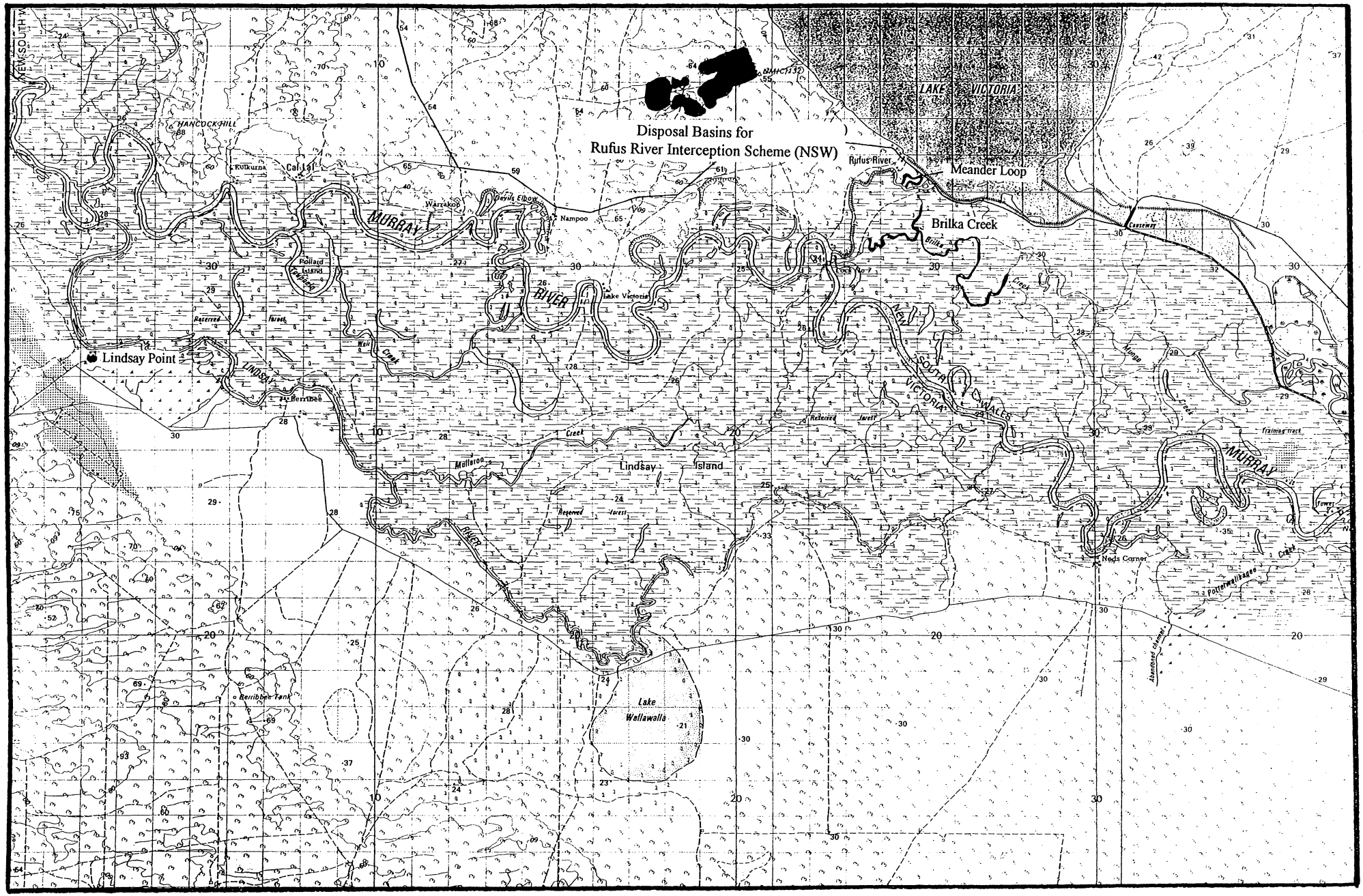


Figure 7 Location of saline water disposal basins, Lake Victoria, NSW.

Grid is 1 kilometre square

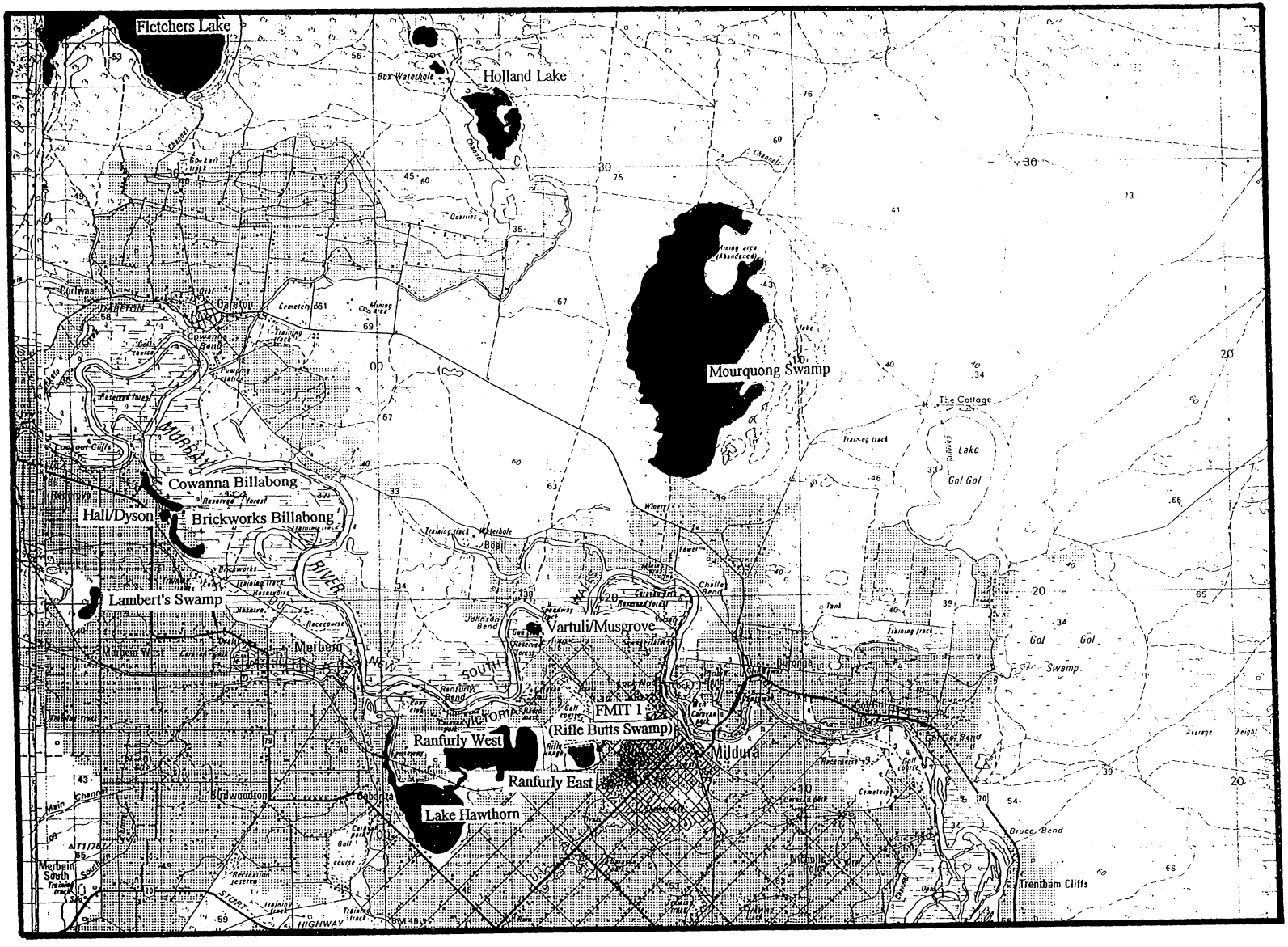
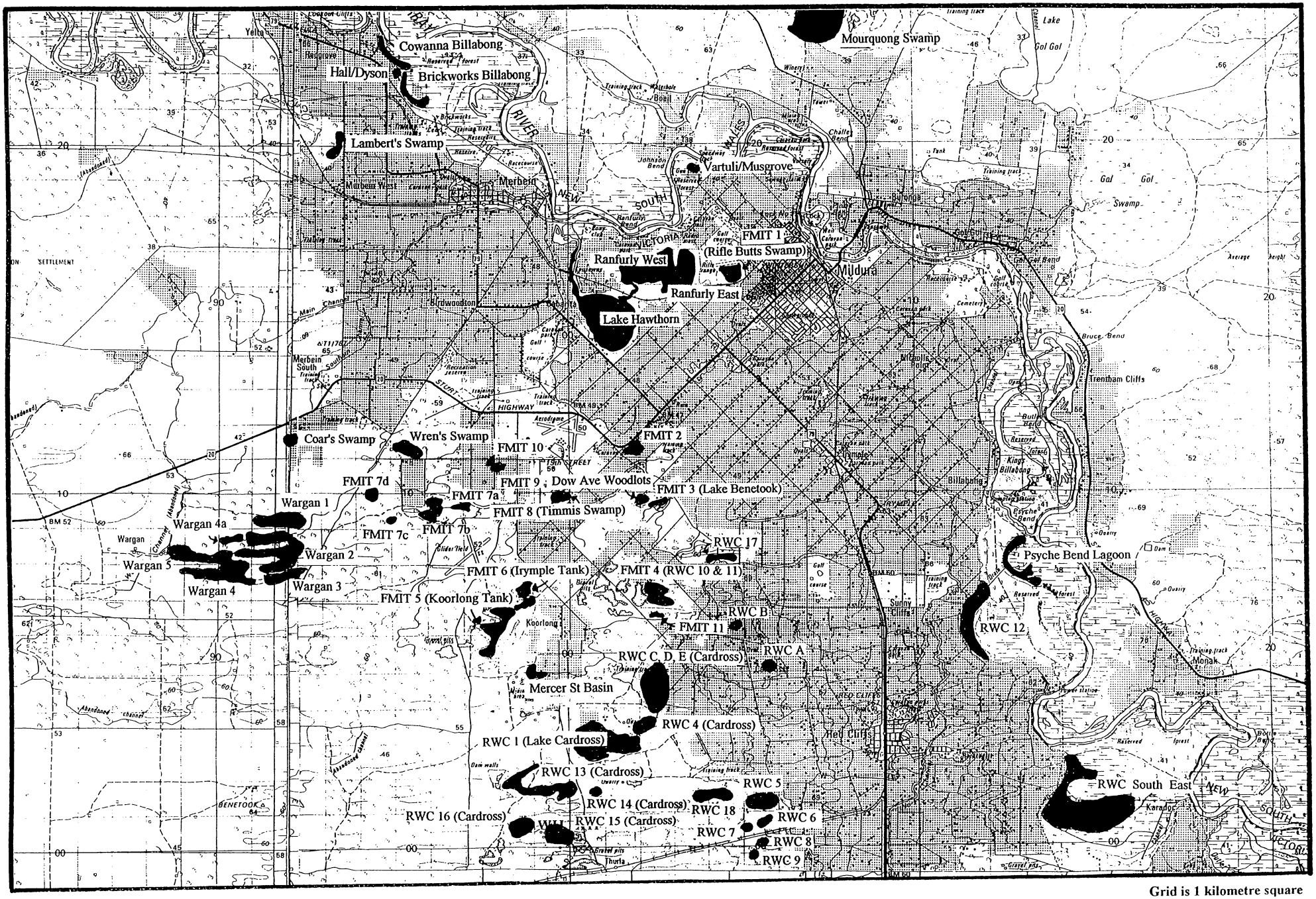
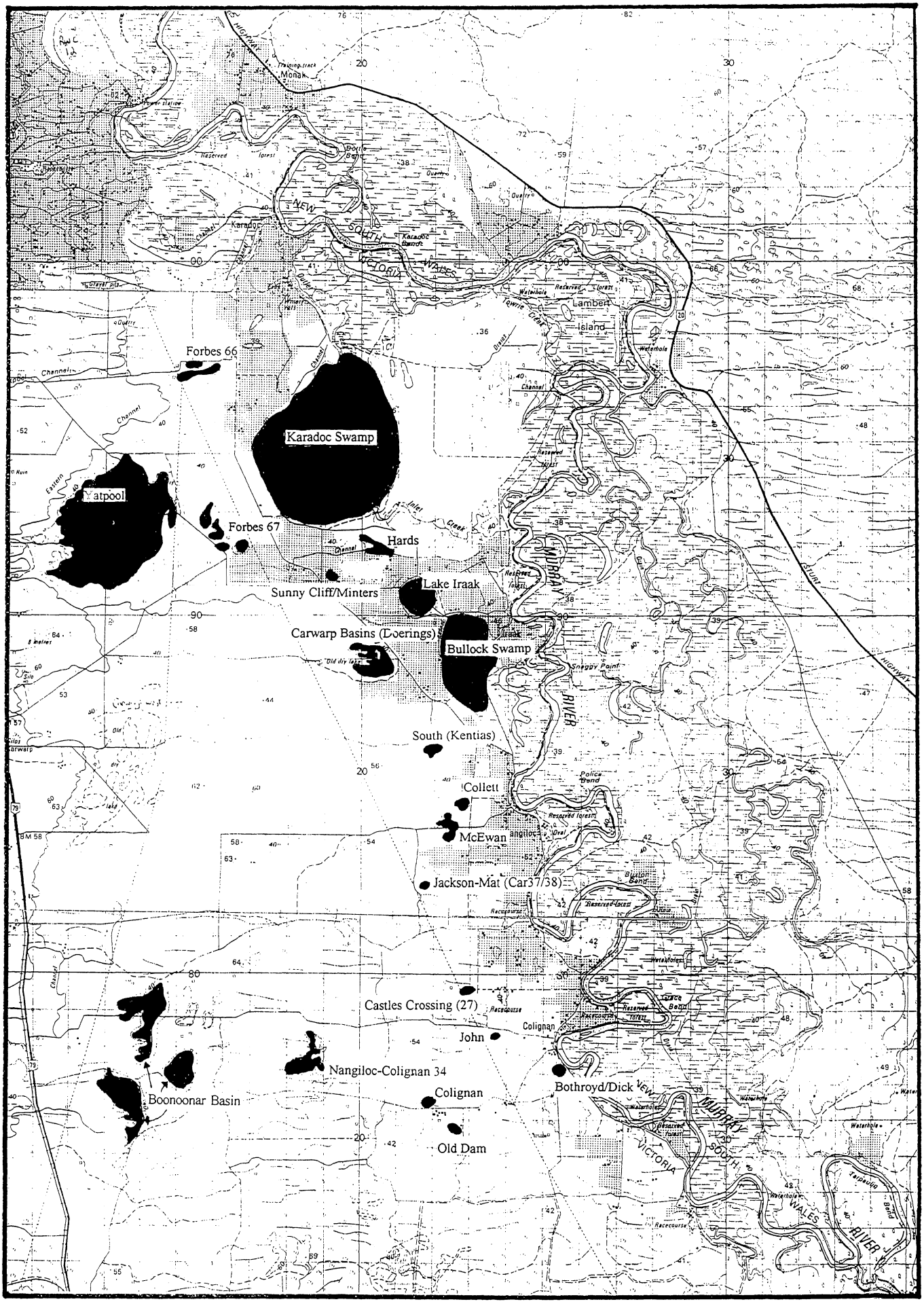


Figure 8 Location of saline water disposal basins, Coomealla-Buronga region, NSW.

Figure 9 Location of saline water disposal basins, Mildura region, Vic.

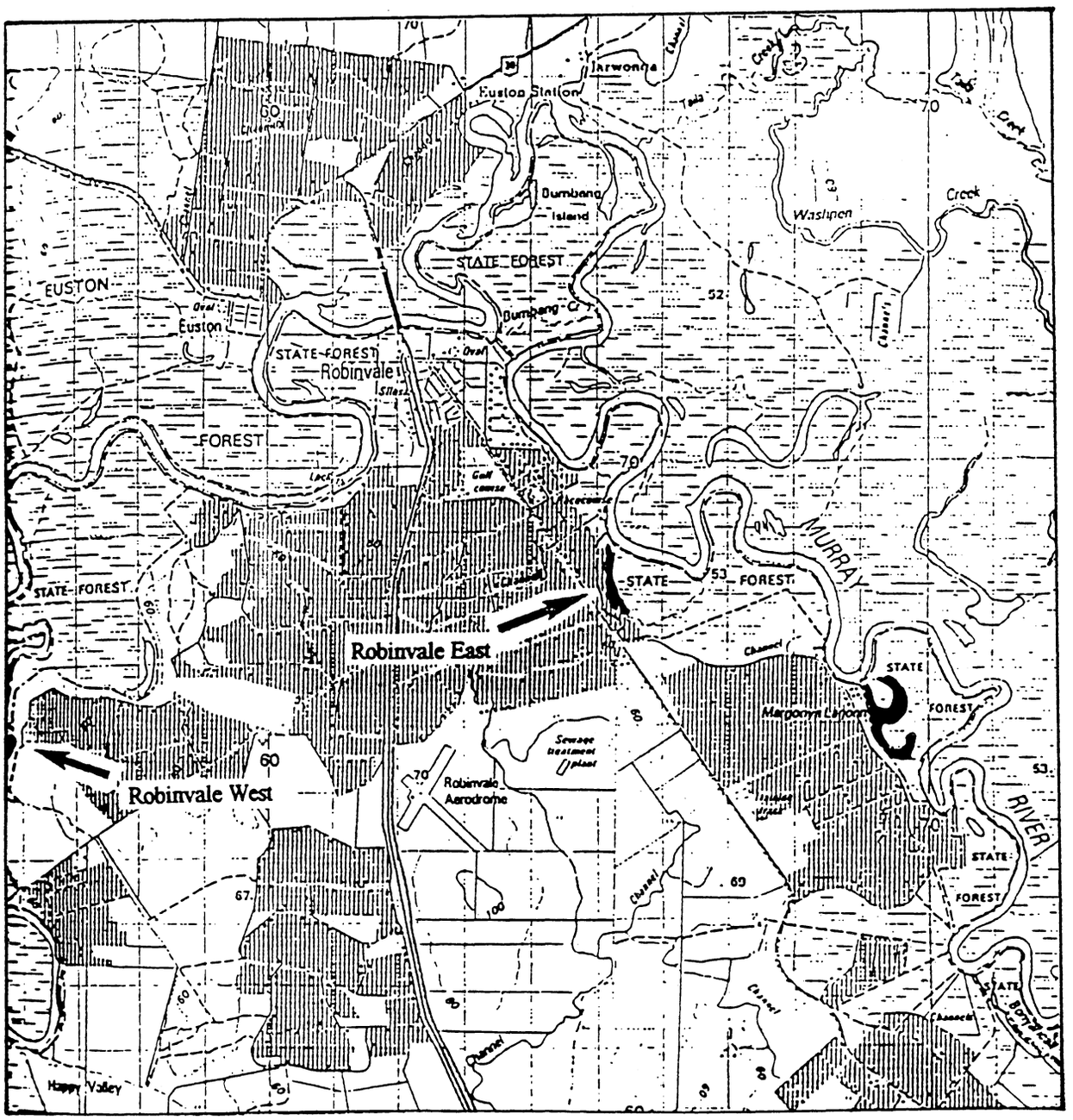


Grid is 1 kilometre square



Grid is 1 kilometre square

Figure 10 Location of saline water disposal basins, Nangiloc-Colignan region, Vic.



Grid is 1 kilometre square

Figure 11 Location of saline water disposal basins, Robinvale area, Vic.

after (Hoxley, 1991, TN1)

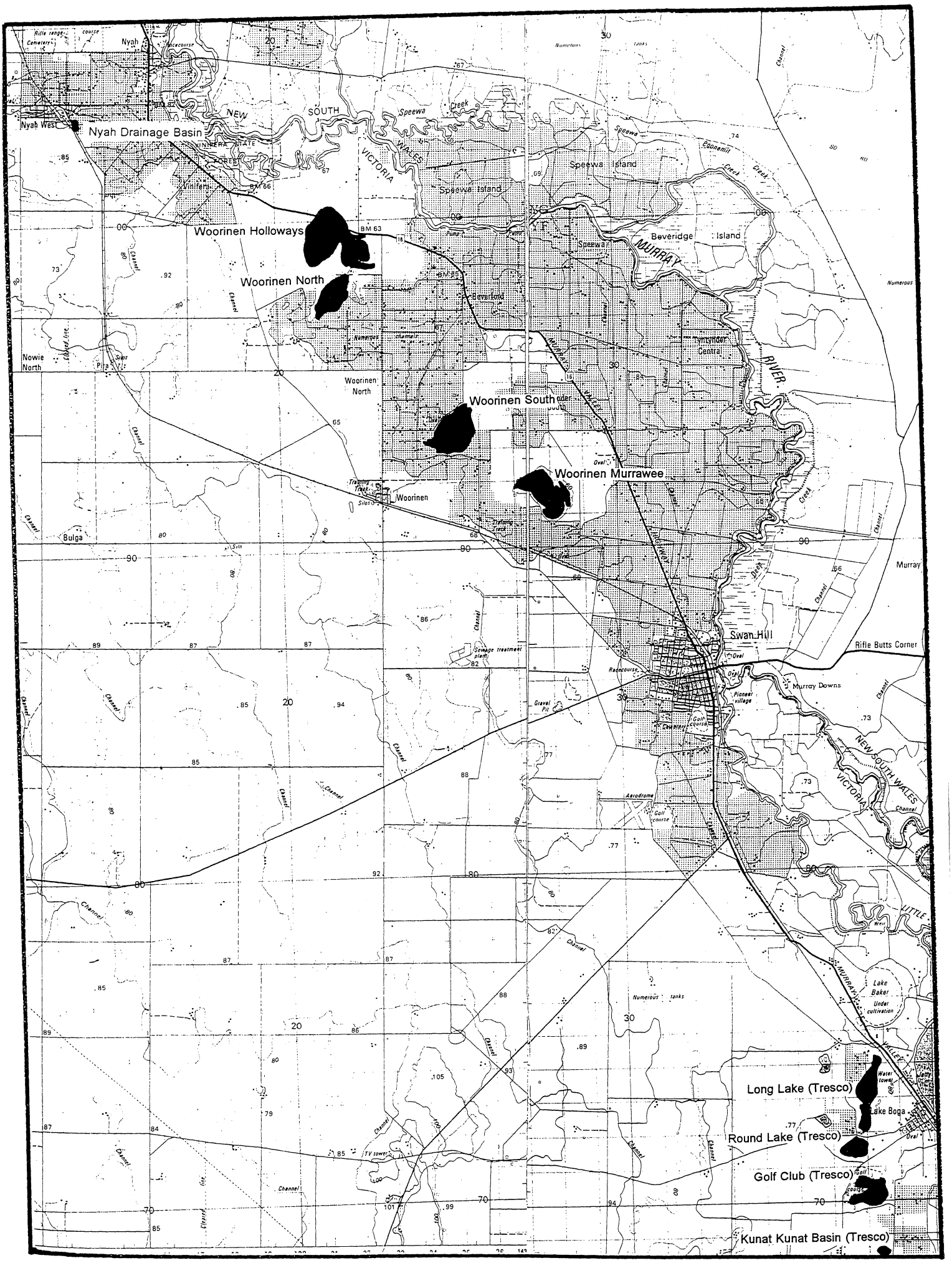
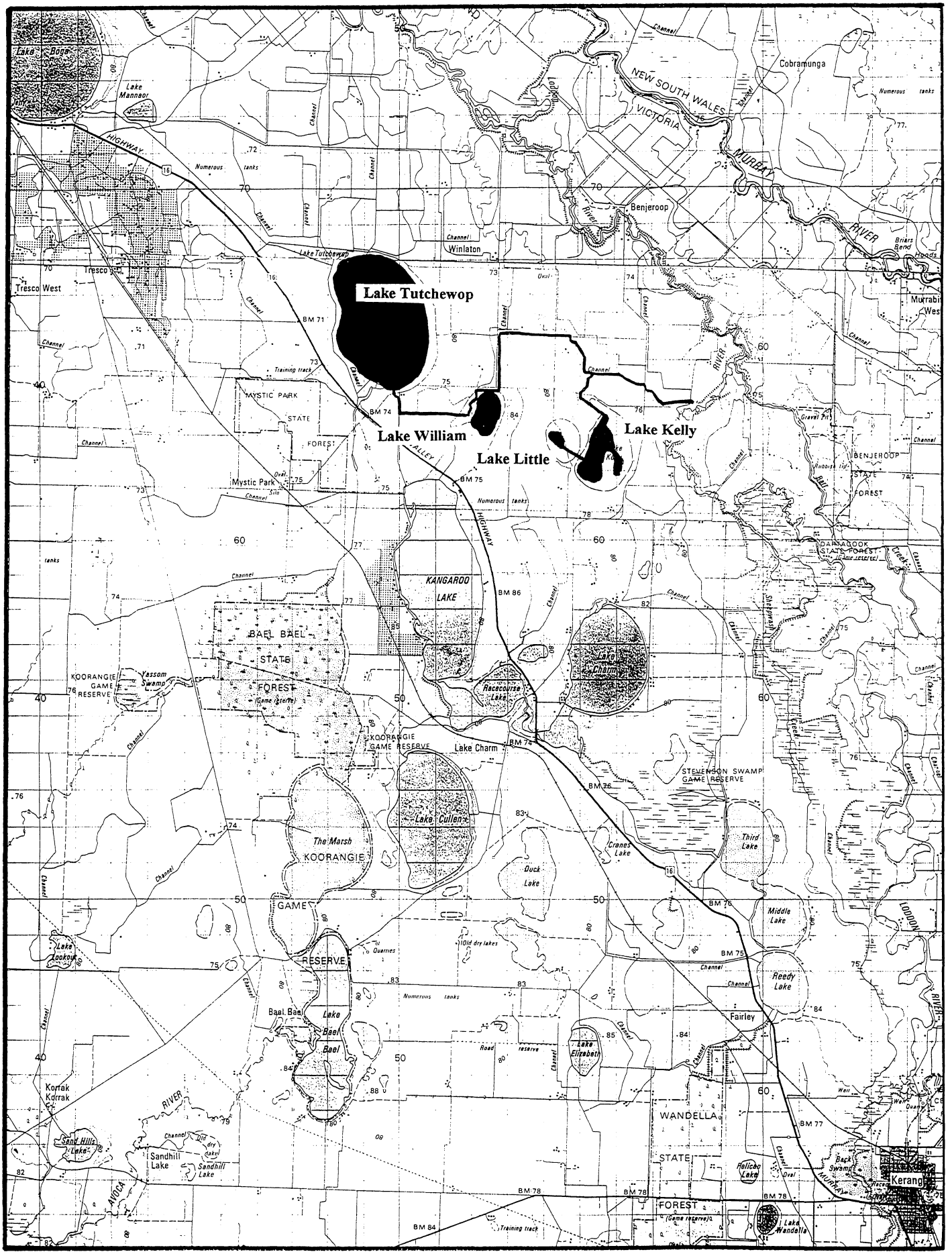


Figure 12 Location of saline water disposal basins, Swan Hill region, Vic.



Grid is 1 kilometre square

Figure 13 Location of saline water disposal basins, Kerang region, Vic.

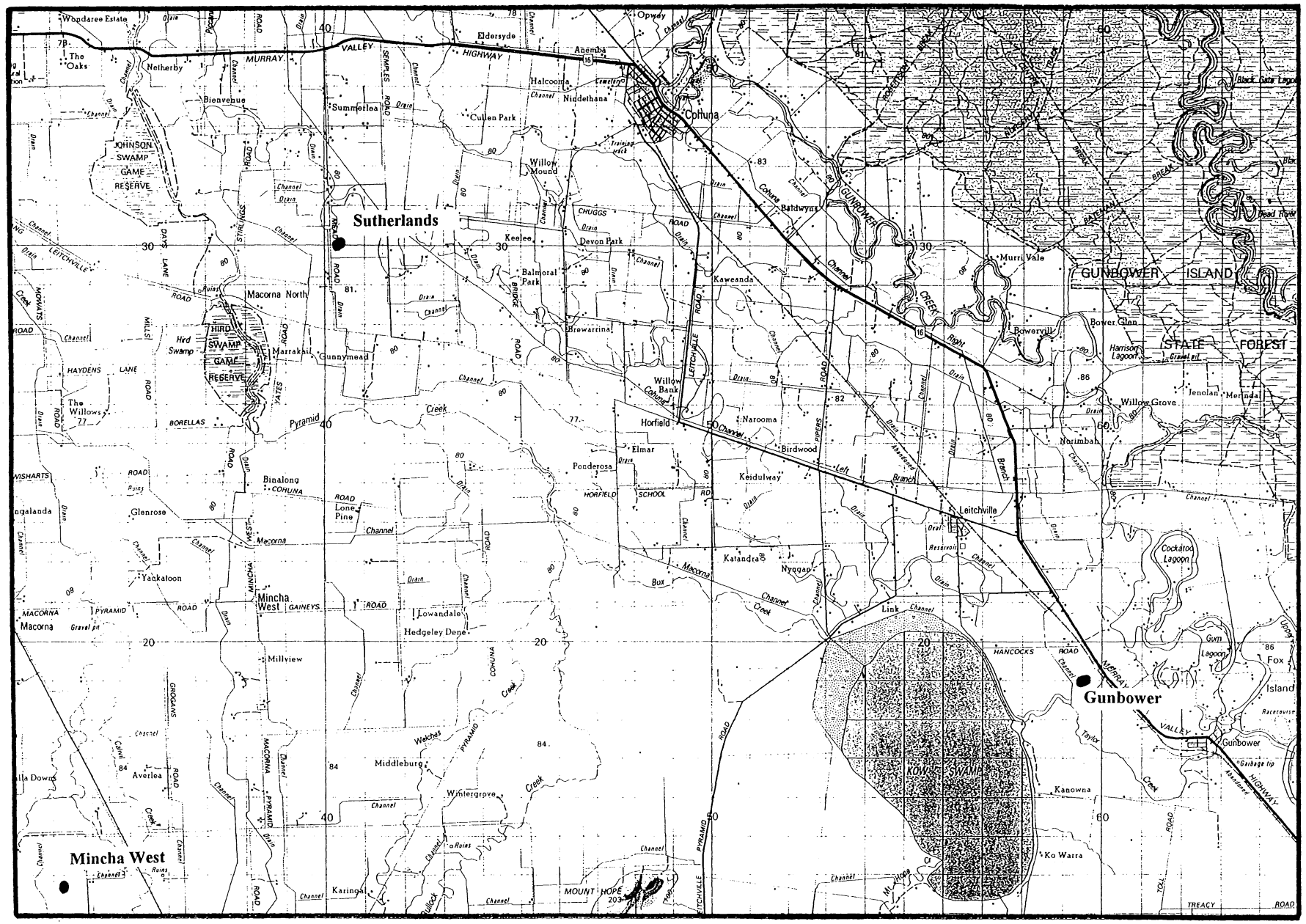


Figure 14 Location of saline water disposal basins, Cohuna region, Vic.

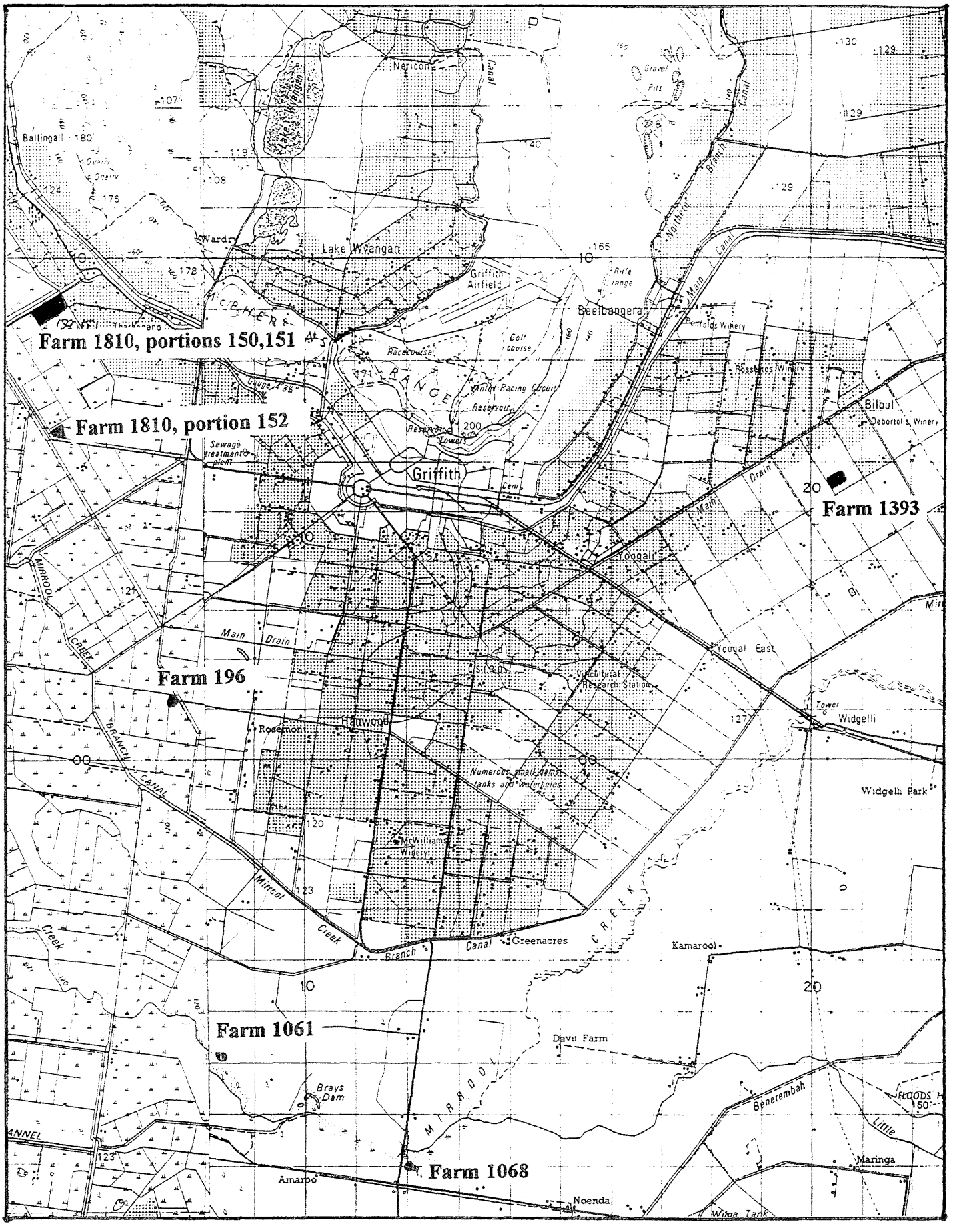


Figure 15 Location of saline water disposal basins, Griffith area, NSW

CONGLOMERATE

GRAVEL

COARSE SAND

MEDIUM SAND

SAND

FINE SAND

LOAMY SAND

SILTY SAND

CLAYEY SAND

CEMENTED SAND

SANDSTONE

PARILLA

SILT

SANDY SILT

CLAYEY SILT

CLAYEY SANDY SILT

CARBONACEOUS SILT

LOAM

SANDY LOAM

SANDY CLAYEY LOAM

CLAYEY LOAM

LIMESTONE LOAM

MUD

DOLOMITIC MUDSTONE

LIMESTONE-MUDSTONE

LIMESTONE-SHALE

SHALE

LIMY SHALE

LIGHT CLAY

MEDIUM CLAY

CLAY

HEAVY CLAY

VERY SANDY CLAY

SANDY CLAY

SILTY SANDY CLAY

SANDY SILTY CLAY

SILTY CLAY

CLAYEY SANDY CLAY

LOAMY CLAY

LOAMY SANDY CLAY

Limestone Clay

DOLOMITE

LIMESTONE

SANDY LIMESTONE

SHALY LIMESTONE

CLAYEY LIMESTONE

LOAM CLAY LIMESTONE

CHERTY LIMESTONE

CLAY AND LIMESTONE

GYPSUM

COPI

SALT

KAOLIN

SILCRETE

IRON STONE

BASEMENT

Figure 16 Lithological symbols for stratigraphic cross-sections

Appendix 1

Locations and elevations of boreholes used for stratigraphic sections

Bore numbers and locations used in cross-section: NSW

Bore ID	Zone	Eastings (AMG)	Northings (AMG)	EL m (AHD)
1012	54	607850	6229100	33.50
1022	54	596350	6232650	32.07
1024	54	592650	6236250	34.49
1025	54	594850	6235700	32.87
1056	54	606450	6220470	37.00
1057	54	606870	6221920	48.00
1058	54	605600	6223380	59.00
1127	55	244386	6088222	73.68
1128	55	244390	6088250	74.18
1129	55	244390	6088274	73.39
1475	55	244348	6087905	74.44
2620	55	244375	6088180	73.80
2650	55	244395	6088320	73.32
2721	55	244405	6088447	73.03
2723	55	244415	6088507	73.06
2725	55	244420	6088562	72.97
2727	55	244425	6088635	73.03
2729	55	244428	6088700	72.72
2731	55	244431	6088765	73.16
2732	55	244435	6088800	73.53
2734	55	244415	6088842	73.39
2757	55	244220	6088691	73.23
2764	55	244455	6089050	73.62
844	55	244365	6088065	73.38
M1	54	606300	6226000	28.00
M14	54	607300	6228400	28.70

R9500403

Bore numbers and locations used in cross-section: Victoria

Bore ID	Zone	Eastings (AMG)	Northings (AMG)	EL m (AHD)
KEM CSIRO	54	756175	6061575	77.43
TSMT	54	749150	6064500	72.40
KEM 2	54	755625	6062250	70.53
KEM 4	54	755850	6062200	72.43
6006	54	752800	6066800	71.84
6024	54	747345	6065837	72.21
6652	54	752750	6066930	71.78
6680	54	752700	6064300	72.62
6687	54	753100	6062400	75.19
6691	54	749285	6063537	72.99
6692	54	747900	6068300	71.68
6695	54	748150	6067800	70.94
7002	54	616036	6194665	39.60
7011	54	612580	6181352	42.12
7013	54	612391	6178837	44.01
7018	54	619180	6176729	40.50
7022	54	624311	6173886	42.43
7027	54	623219	6176368	43.25
7032	54	620980	6188764	39.99
7033	54	623480	6190024	41.77
7034	54	623177	6186529	42.01
7036	54	620459	6186230	42.91
7039	54	611080	6176911	44.40
7053	54	621988	6194670	41.49
7054	54	621041	6194618	42.06
7226	54	598501	6208307	44.36
7257	54	602229	6216919	36.85
7332	54	599584	6217766	40.20
7365	54	604545	6217730	37.79
7368	54	605267	6216658	42.02
7369	54	604736	6217071	36.26
7372	54	606895	6215412	46.21
7400	54	599282	6217995	54.76
7410	54	605538	6202309	63.48
7420	54	599375	6217214	53.33
7421	54	600245	6215314	37.55
7422	54	600435	6213742	49.47
7423	54	599799	6210925	51.37
7443	54	597304	6222201	35.64
7444	54	595655	6222122	36.49
7445	54	595551	6222641	34.99
7446	54	595530	6222750	36.25
7464	54	612937	6205319	39.73
7493	54	612981	6194617	36.84
7494	54	612931	6188880	48.12
7500	54	618074	6194617	36.74
7508	54	620041	6194613	36.52
7510	54	617187	6194523	38.42
7513	54	612977	6193911	36.43

Bore numbers and locations used in cross-section: Victoria

7515	54	612991	6193266	36.19
7523	54	621790	6176625	40.00
7524	54	623932	6199605	40.37
7548	54	612971	6192299	36.06
7562	54	621531	6191781	41.22
7649	54	624722	6194604	40.04
7651	54	621500	6192652	41.37
7690	54	612495	6207168	38.38
7701	54	600445	6217693	36.14
7733	54	612599	6207392	38.45
7743	54	603615	6203530	43.15
7744	54	606368	6203767	64.42
7745	54	603222	6207285	47.99
7772	54	593640	6218589	42.05
7774	54	593690	6219172	40.38
7778	54	593661	6219720	36.11
7780	54	593659	6220423	34.45
7782	54	593695	6220878	35.09
7978	54	611800	6208700	37.65
7981	54	612450	6208200	38.64
7983	54	613450	6207150	38.73
7985	54	614300	6206900	36.88
7992	54	614200	6200600	39.25
7994	54	614450	6201250	39.14
7996	54	614850	6202450	37.54
26116	54	725650	6099000	65.54
26132	54	724100	6092700	65.00
26136	54	725950	6091450	65.76
26318	54	724800	6098100	65.07
26322	54	724800	6096600	65.84
26342	54	724800	6097600	65.53
26366	54	729650	6091950	68.20
26802	54	723100	6092700	69.02
26803	54	727000	6094900	67.76
26804	54	725900	6093500	64.10
27142	54	597300	6205600	38.53
27147	54	596000	6209800	52.07
27150	54	596000	6209900	51.71
27177	54	622981	6183983	40.81
27179	54	622450	6184320	40.23
27180	54	622820	6184770	39.77
27182	54	622720	6184920	39.89
27186	54	622140	6186540	41.51
113331	54	750100	6065900	81.70
115381	54	752900	6064000	68.99
115382	54	754875	6062175	70.58
115412	54	748200	6065800	71.60

South Australia

<Site Name> Berri Evaporation Basin
<Synonyms> Berri Disposal Basin

Spatial

<**Location description**> 3.5 kilometres SW of Berri P.O., on swampy floodplain adjacent to river and rimmed by Berri Irrigation Area to NW.

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Renmark

<**Location 1:100 000**> Renmark 7029

<**Zone**> 54H

<**Coordinates easting (AMG)**> 460000

<**Coordinates northing (AMG)**> 6204500

<**State**> South Australia

General

<**Year begun operation**> 1940

<**Active/inactive**> Active

<**Full surface area (ha)**> 400 ha at 14.70 m AHD; operational 150 ha at 13.20 m AHD

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> 14.70 m AHD; Since diversion to Noora the basin operates at 13.2 m AHD, equal to the water level in Lock 4.

<**Groundwater level (m AHD)**> River level at 13.22 m AHD

<**Groundwater seepage/discharge**> Discharge would have occurred during the operating life of the basin, since keeping the basin at river level it receives seepage from the irrigation mound.

<**Average annual evaporation**> Regionally: 2240 mm/yr (Kernich, 1984); Locally: 1600-1700 mm/yr (Kernich's number more applicable to highland dryland sites (K. Smith, pers. comm.))

<**Volume disposed annually (ML/yr)**> 3985 ML/yr released to river; and 720 ML/yr disposed at Noora (Smith and Watkins, 1993). For 1986/87, inflow to basin 3985 ML with 1500 ML pumped to Noora, also some disposal to the river during high flows (year not necessarily typical) (K. Smith, pers. comm.)

<**Salinity of water disposed (EC)**> 6820 mg/L

<**Range of salinity in basin (EC)**> 239-24,500 mg/L

<**Sources of water to be disposed**> Irrigation drainage water from Berri Irrigation Area (Industrial flushing has ceased)

<**Terminal/throughflow basin**> Flushing capacity at high flows in river, otherwise water is pumped to Noora Disposal Basin (pumping commenced in 1982)

<**Range of elevation of lake surface with disposal**> 12.70-14.97 m AHD

<**Lining/treatment of base**> None

<Site Name> Berri Evaporation Basin
<**Synonyms**> Berri Disposal Basin

<**Review of environmental impacts**> High storage levels in the basin (up to 1.5 m above adjacent river pool level) during the 1970's induced large salt loads to the river and accelerated the ongoing environmental degradation within and surrounding the basin. Because of the changing hydrology and contamination from salinity and toxins in the basin, there are numerous dead River Red Gum (*Eucalyptus camaldulensis*) and River Box (*E. largiflorens*). Living trees only survive on sand ridges (EWS, 1989a). However, since the Noora Drainage Disposal Scheme came on line in 1982, operating levels in the basins have been lowered reducing the impact on the vegetation and floodplain, which has since recovered significantly (K. Smith, pers. comm.) Construction works were undertaken in 1991 to facilitate flushing of the basin during high river flows. Agencies and community groups have been involved in a range of studies aimed at rehabilitation of the area.

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> SA Engineering and Water Supply

<**Project name**> Berri Comprehensive Drainage Scheme

<**Natural, modified natural or constructed**> Modified natural, swamp lagoon

<**Modification type and degree**> Has flushing culverts and pipes, water discharges into Eckerts Creek via a 900 mm diameter pipe to allow flushing of the basin.

Geological

<**Site description and Geomorphology**> The basin is located on the lower floodplain of the River Murray and is swampy and prone to flooding during high flows. There are a number of sub-basins isolated from the river by banks.

<**Subsurface investigations at site**>

<**Structural setting**> The basin lies east of the Hamley Fault and within the Renmark Trough (Firman, 1972).

<**Stratigraphic setting**> The basin is floored by the Coonambidgal Formation (2 m), and is underlain by the Monoman Formation (20 m), the Bookpurnong Beds (10-15 m), the Murray Group Limestone (110 m), and the Renmark Group (240 m) (Geology interpreted from Firman, 1972).

<**Host formation**> Coonambidgal Formation

<**Host lithofacies**> Organic silty sand, sandy clay, and silt

<**Aquitard**> Coonambidgal Formation and Bookpurnong beds

<**Aquitard lithofacies**> Coonambidgal Formation: Organic silty sand, sandy clay, and silt; Bookpurnong Beds: Dark grey silt and clay, and very shelly sand

<**Aquifer**> Monoman Sand

<**Aquifer lithofacies**> Yellow, medium to coarse micaceous sand

<Site Name> Berri Evaporation Basin
<Synonyms> Berri Disposal Basin

<Comments>

Summary of Hydrodynamics

<Distance to Murray or tributary> <500 metres

<Head between basin and river/tributary> Since 1982, basin has operated at river level (Pre 1982 basin 1-1.5 metres above river)

<Direction of groundwater flow in regional aquifer> Water table mound beneath Berri Irrigation Area has exaggerated natural regional flow from the northwest towards the floodplain (S. Barnett, pers. comm.)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Coonambidgal Formation: 2 metres; Bookpurnong Beds: 10-15 metres

<kv and kh of aquifer> Monoman Formation: Kh = 10-20 m/day

<EC of aquifer> 10,000-35,000 mg/L (K Smith, pers. comm.)

<Porosity of aquifer>

<Thickness of aquifer> Monoman Formation: 20 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Prior to the start of the Noora Drainage Disposal Scheme in 1982 the basin operated from 1 to 1.5 metres above the river which induced flow towards the Murray. Seepage was mainly through the Coonambidgal Formation and then into the Monoman Formation which is in direct contact with the river. The Monoman Formation may also receive discharge from the Murray Group Limestone, however flow would be strongly retarded by the overlying Bookpurnong Beds (actual input from the Murray Group is unknown). Since 1982, the basin has operated at or below the river level which has reduced the flow towards the river and has allowed re-establishment of floodplain vegetation.

<Hydraulic linkage to surface runoff> Basin is flooded during a 1 in 2 year flood (50,000 ML/day) (Jacobs and Collingham, 1984)

<Category - hydraulic stability>

<Site Name> Berri Evaporation Basin
<Synonyms> Berri Disposal Basin

<Category - degree of hydraulic isolation>

<Evaporation surplus> Evaporation capacity is 1600 ML/yr (K. Smith, pers. comm.)

Interpretive 2

<Ranking of sustainability>

References Cited

Engineering and Water Supply (E&WS) (South Australia), 1989a- Enhancing wetlands., South Australian River Murray Wetlands Working Party Report, Engineering and Water Supply Department and Department of Environment and Planning, EWS 1439/88, Report no. 88/7, 174 p.

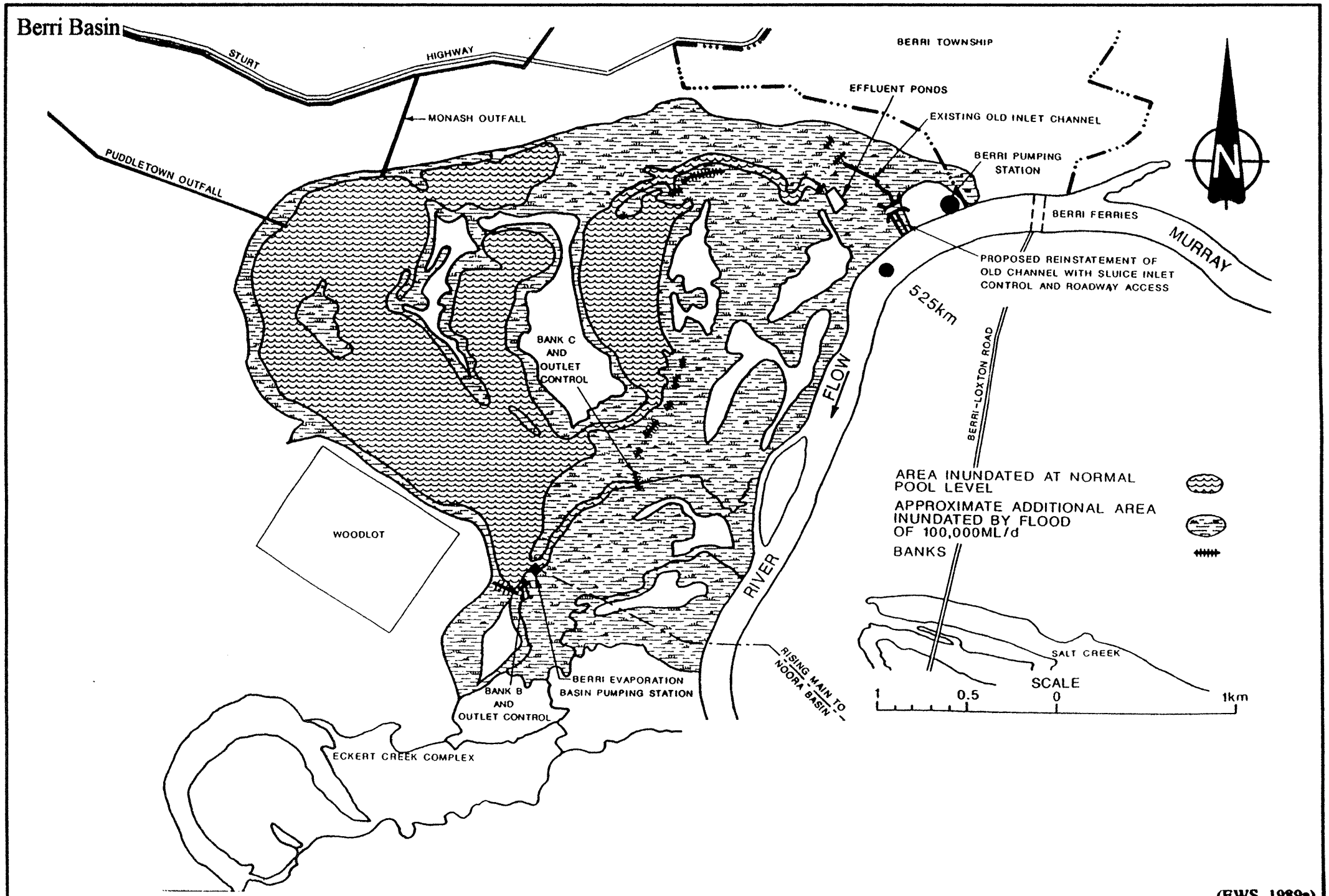
Firman, J.B., 1972- Renmark, South Australia - 1:250 000 Geological Series., Geological Survey of South Australia, Explanatory notes, SI/54-10.

Jacobs, T., and Collingham, E.B., 1984- River Murray Phase II Studies: Berri East Groundwater Interception Scheme: Summary report., South Australia Engineering and Water Supply, EWS 730/84.

Kernich, A.M., 1984- The climate of the River Murray and environs, South Australia., Technical report, South Australia Department of Agriculture.

Smith, K.G., and Watkins, N., 1993- Border to the Barrages - Natural resource criteria for sustainable irrigation on the River Murray., River Murray Water Resources Committee, 100 p.


N
Berri Council Stormwater
Berri East C.D.
Berri Basin
1 km
0
1 km
2 km
(16/2/1975)


Berri Basin
STURT HIGHWAY
BERRI TOWNSHIP
EFFLUENT PONDS
EXISTING OLD INLET CHANNEL
MONASH OUTFALL
PUDDLETOWN OUTFALL
BERRI PUMPING STATION
BERRI FERRIES
MURRAY
PROPOSED REINSTATEMENT OF OLD CHANNEL WITH SLUICE INLET CONTROL AND ROADWAY ACCESS
525km
BANK C AND OUTLET CONTROL
BERRI-LOXTON ROAD
FLOW
WOODLOT
RIVER
AREA INUNDATED AT NORMAL POOL LEVEL
APPROXIMATE ADDITIONAL AREA INUNDATED BY FLOOD OF 100,000ML/d
BANKS
SALT CREEK
SCALE
1 0.5 0 1km
RISING MAIN TO NOORA BASIN
BERRI EVAPORATION BASIN PUMPING STATION
BANK B AND OUTLET CONTROL
ECKERT CREEK COMPLEX

(EWS, 1989a)

<Site Name> Berri Council Stormwater
<Synonyms>

Spatial

<**Location description**> Alongside marina near Berri, SA at caravan park.

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Renmark

<**Location 1:100 000**> Renmark 7029

<**Zone**> 54H

<**Coordinates easting (AMG)**> 462700

<**Coordinates northing (AMG)**> 6205600

<**State**> South Australia

General

<**Active/inactive**> Active

<**Full surface area (ha)**>

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> 14.89 m AHD

<**Groundwater level (m AHD)**> <14.0 m AHD (Barnett, 1991); Actual level depends on river height, long term level is 13.2 m AHD

<**Groundwater seepage/discharge**> Seepage if basin level is higher than the river, and discharge if river is higher than the basin

<**Average annual evaporation**> 1600-1700 mm/yr (K. Smith, pers. comm.)

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**> 363-9200 EC

<**Sources of water to be disposed**> Part flushing facility: used as a retention basin

<**Terminal/throughflow basin**> Partial flushing capacity

<**Range of elevation of lake surface with disposal**> 13.45-14.45 m AHD

<**Lining/treatment of base**>

<**Year begun operation**> 1986?

<**Review of environmental impacts**>

<Site Name> Berri Council Stormwater
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Berri Council

<**Project name**> Berri Council Storm Water

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Controls - 1 outlet/ 2 inlets

Geological

<**Site description and Geomorphology**> The basin is located in a remnant of a stranded meander on the floodplain of the Murray River. It is surrounded by Red River Gums and River Box, and is flooded during high water levels (1 in 5 years, 90,000 ML/day).

<**Subsurface investigations at site**>

<**Structural setting**> The basin lies east of the Hamley Fault and within the Renmark Trough (Firman, 1972).

<**Stratigraphic setting**> The basin is floored by the Coonambidgal Formation (2 m), and is underlain by the Monoman Formation (20 m), the Bookpurnong Beds (10-15 m), the Murray Group Limestone (110 m), and the Renmark Group (240 m) (Geology interpreted from Firman, 1972).

<**Host formation**> Coonambidgal Formation

<**Host lithofacies**> Organic silty sand, sandy clay, and silt

<**Aquitard**> Coonambidgal Formation and Bookpurnong Beds

<**Aquitard lithofacies**> Coonambidgal Formation: Organic silty sand, sandy clay, and silt; Bookpurnong Beds: Dark grey silt and clay, and very shelly sand

<**Aquifer**> Monoman Sand

<**Aquifer lithofacies**> Yellow, medium to coarse micaceous sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 500 metres

<**Head between basin and river/tributary**> 1.6 metres (Basin at 14.89 m AHD and river at 13.2 m AHD)

<**Direction of groundwater flow in regional aquifer**> Water table mound beneath Berri Irrigation Area has exaggerated natural regional flow from the northwest towards the floodplain (Barnett, pers. comm.).

<Site Name> Berri Council Stormwater
<Synonyms>

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Coonambidgal Formation: 2 metres; Bookpurnong Beds: 10-15 metres

<kv and kh of aquifer> Monoman Formation: Kh = 10-20 m/day

<EC of aquifer> 10,000-35,000 mg/L (K Smith, pers. comm.)

<Porosity of aquifer>

<Thickness of aquifer> Monoman Formation: 20 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin has the capacity to discharge into the river, because its full level is higher than mean river level. The difference in hydraulic head drives disposal water through the Coonambidgal Formation, and into the Monoman Formation which is in direct contact with the River Murray. The Monoman Formation may also receive discharge from the Murray Group Limestone, however flow would be strongly retarded by the overlying Bookpurnong Beds, so actual input from the Murray Group is unknown. In the area, the Parilla Sand and the Monoman Formation form a combined aquifer, that is driven mainly by the irrigation mound beneath Berri Irrigation Area. The amount of water coming from the irrigation area is far in excess of the amount of water in the basin, and as the basin contains relatively freshwater, there should be no significant input into the river from the basin.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

<Site Name> Berri Council Stormwater
<Synonyms>

Interpretive 2

<Ranking of sustainability>

References Cited

Barnett, S.R. (South Australia Department of Mines and Energy), 1991- Renmark Hydrogeologic Map (1:250 000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia

Firman, J.B., 1972- Renmark, South Australia - 1:250 000 Geological Series., Geological Survey of South Australia, Explanatory notes, SI/54-10.


N
Berri Basin
Berri Council Stormwater
Berri East C.D.
1 km
0
1 km
2 km

<Site Name> Berri East Evaporation Basin
<Synonyms> Berri East Disposal Basin

Spatial

<Location description> 2.5 kilometres ESE of Berri, SA on the recreation ground on Martin Bend.

<Located in Murray Trench> Yes

<Location 1:250 000> Renmark

<Location 1:100 000> Renmark 7029

<Zone> 54H

<Coordinates easting (AMG)> 46550

<Coordinates northing (AMG)> 620550

<State> South Australia

General

<Year begun operation>

<Active/inactive> Inactive

<Full surface area (ha)>

<Volume capacity (ML)>

<Full surface level (m AHD)>

<Groundwater level (m AHD)>

<Groundwater seepage/discharge> Seepage

<Average annual evaporation>

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)>

<Sources of water to be disposed>

<Terminal/throughflow basin> Throughflow- discharges to river

<Range of elevation of lake surface with disposal>

<Lining/treatment of base>

<Review of environmental impacts>

Engineering/Admin

<Public or private operation> Public

<Site Name> Berri East Evaporation Basin
<Synonyms> Berri East Disposal Basin

<Agency responsible> SA Engineering and Water Supply

<Project name> Berri East Groundwater and Drainage Interception Scheme

<Natural, modified natural or constructed>

<Modification type and degree>

Geological

<Site description and Geomorphology> Floodplain site on the River Murray between Berri and Martins Bend.

<Subsurface investigations at site> Piezometers, DME bores, EWS bores

<Structural setting> The basin lies east of the Hamley Fault and within the Renmark Trough (Firman, 1972).

<Stratigraphic setting> The basin is floored by the Coonambidgal Formation (5-10 m), and is underlain by the Monoman Formation (10 m), and a clayey sand (5 m) which is part of an older valley base (Parilla Sand: S. Barnett, pers. comm.), the Bookpurnong Beds (15-22 m), and the Murray Group Limestone (Jacobs and Collingham, 1984).

<Host formation> Coonambidgal Formation

<Host lithofacies> Clays, silts, silty sands and sands (Jacobs and Collingham, 1984)

<Aquitard> Coonambidgal Formation and Bookpurnong Beds

<Aquitard lithofacies> Coonambidgal Formation: Clays, silts, silty sands and sands (Jacobs and Collingham, 1984); Bookpurnong Beds: Dark grey silt and clay, and very shelly sand

<Aquifer> Monoman Formation and Parilla Sand

<Aquifer lithofacies> Monoman Formation: Sands, gravelly sand, gravels, and silty sands (Jacobs and Collingham, 1984); Parilla Sand: Clayey sand? (Within the trench, the Monoman Formation and the Parilla Sand act as a combined aquifer)

<Comments>

Summary of Hydrodynamics

<Distance to Murray or tributary> <500 metres

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Southeast towards the river (Barnett, 1991)

<**Site Name**> Berri East Evaporation Basin
<**Synonyms**> Berri East Disposal Basin

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**>

<**Thickness of aquitard**> Coonambidgal Formation: 5-10 metres; Bookpurnong Beds: 22 metres (Jacobs and Collingham, 1984); 15 metres (S. Barnett, pers. comm.)

<**kv and kh of aquifer**>

<**EC of aquifer**> 20,000 mg/L salinity (Jacobs and Collingham, 1984)

<**Porosity of aquifer**>

<**Thickness of aquifer**> Monoman Formation: 8 metres; Parilla Sand: 5 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> The full level of the basin is unknown, however it is likely that there is some leakage into the Monoman Formation (in contact with the river). Groundwater flow in the Parilla Sand (and the Monoman Formation) is strongly influenced by the irrigation mound beneath Berri, which acts to push the older saline water from the Parilla into the river (Jacobs and Collingham, 1984). The situation is further complicated because of the very low gradient across Martins Bend, acts to deter flow to the river. Because of the low gradient, seepage from the basin is probably very slow although it may have a high salinity due to evaporative concentration. The actual effect of the basin on the area is unknown, because frequent flooding of the river has acted to keep salinities down.

<**Hydraulic linkage to surface runoff**> On the Murray River floodplain

<**Category - hydraulic stability**>

<**Category - degree of hydraulic isolation**>

<Site Name> Berri East Evaporation Basin
<Synonyms> Berri East Disposal Basin

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

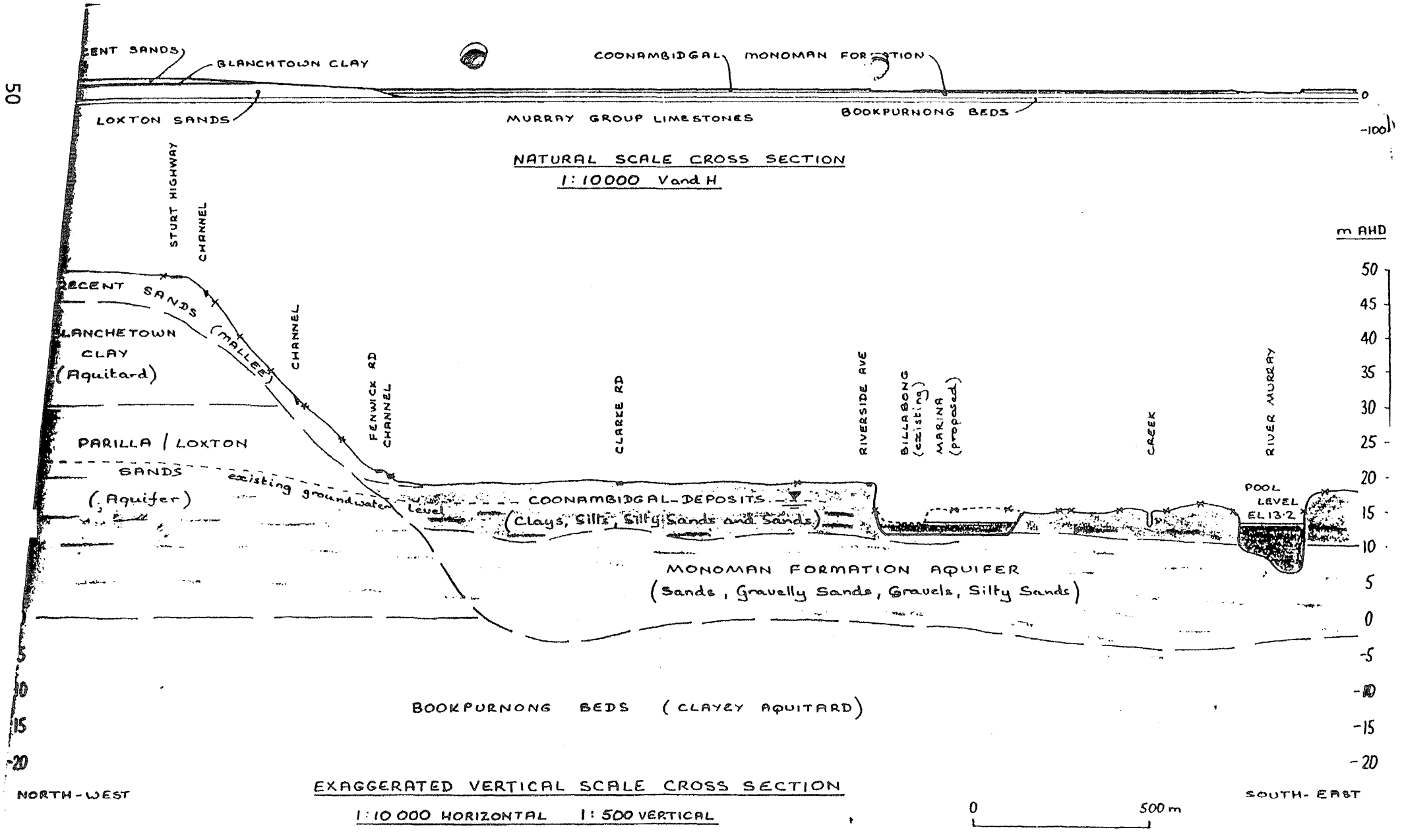
References Cited

Barnett, S.R. (South Australia Department of Mines and Energy), 1991- Renmark Hydrogeologic Map (1:250 000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia

Firman, J.B., 1972- Renmark, South Australia - 1:250 000 Geological Series., Geological Survey of South Australia, Explanatory notes, SI/54-10.

Jacobs, T., and Collingham, E.B., 1984- River Murray Phase II Studies: Berri East Groundwater Interception Scheme: Summary report., South Australia Engineering and Water Supply, EWS 730/84.


N
Berri Council Stormwater
Berri East C.D.
Berri Basin
1 km
0
1 km
2 km



Note: Groundwater salinities in Loxton Sands and Monoman Formation typically 20 000 mg/L.

HYDROGEOLOGICAL CROSS SECTION THROUGH MARTINS BEND BERRI

(Collingham, 1989)

<Site Name> Block 'E' Floodplain
<Synonyms>

Spatial

<**Location description**> 4 kilometres due north of Renmark, SA along Ral Ral Creek. May be reached by turning right off Ral Ral Avenue into Goolwa Street to the end (3-4 km).

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Renmark

<**Location 1:100 000**> Renmark 7029

<**Zone**> 54H

<**Coordinates easting (AMG)**> 477000

<**Coordinates northing (AMG)**> 6223200

<**State**> South Australia

General

<**Year begun operation**> early 1960's

<**Active/inactive**> Abandoned in 1967, used by RIT and EWS (for Ral Ral CDS) prior to Bulyong Island Basin

<**Full surface area (ha)**> 125 ha at 17.3 m AHD

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> 17.3 m AHD

<**Groundwater level (m AHD)**>

<**Groundwater seepage/discharge**> Groundwater inflow from irrigation mound and discharge into Ral Ral Creek (K. Smith, pers. comm.)

<**Average annual evaporation**> 1600-1700 mm/yr (K. Smith, pers. comm.)

<**Volume disposed annually (ML/yr)**> 600 ML/yr

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**> 35,000 to 50,000 EC

<**Sources of water to be disposed**> Irrigation drainage water from Renmark and Ral Ral Comprehensive Drainage Schemes (CDS)

<**Terminal/throughflow basin**> Flushed by 1 in 3 year flood

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**>

<**Review of environmental impacts**> Severe salinisation

<Site Name> Block 'E' Floodplain
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> SA Engineering and Water Supply and Renmark Irrigation Trust

<**Project name**> Block 'E' of Renmark

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Small amount of perimeter banking

Geological

<**Site description and Geomorphology**> The basin is located on the floodplain of the Murray River and appears to be a billabong associated with Ral Ral Creek, an anabranch of the Murray. There is severe salinisation and salt scalding around the basin and the surrounding floodplain.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located southeast of the Hamley Fault and within the Renmark Trough (Barnett, 1991).

<**Stratigraphic setting**> The basin is floored by the Coonambidgal Formation (5 m), and underlain by the Monoman Formation (5-7 m), the Parilla Sand (20 m), the Bookpurnong Beds (15 m), the Murray Group Limestone (100 m), and the Renmark Group (400 m) (Geology interpreted from Barnett, 1991).

<**Host formation**> Coonambidgal Formation

<**Host lithofacies**> Organic silty sand, sandy clay, and silt

<**Aquitard**> Coonambidgal Formation and Bookpurnong Beds

<**Aquitard lithofacies**> Coonambidgal Formation: Organic silty sand, sandy clay, and silt; Bookpurnong Beds: Dark grey silt and clay, and very shelly sand

<**Aquifer**> Monoman Formation and Parilla Sand

<**Aquifer lithofacies**> Monoman Formation: Yellow, medium to coarse micaceous sand: Parilla Sand: Yellow to purple, medium to coarse sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 10-100 metres

<**Head between basin and river/tributary**>

<Site Name> Block 'E' Floodplain
<Synonyms>

<**Direction of groundwater flow in regional aquifer**> Northeast towards Ral Ral Creek (Barnett, 1991)

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**>

<**Thickness of aquitard**> Coonambidgal Formation: 5 metres; Bookpurnong Beds: 15 metres

<**kv and kh of aquifer**> Monoman Formation: 10-20 m/day; Parilla Sand: 4 m/day (Jacobs and Collingham, 1984)

<**EC of aquifer**>

<**Porosity of aquifer**>

<**Thickness of aquifer**> Monoman Formation: 5-7 metres; Parilla Sand: 20 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> When the basin was in operation, there were problems due to leakage from the basin into Ral Ral Creek. The leakage occurred because the full level of the basin was higher than the level of the Murray River enabling the disposal water to pass through the Coonambidgal Formation and into the Monoman Formation aquifer, which is in contact with Ral Ral Creek. Ral Ral Creek also receives discharge from the Parilla Sand (in contact with the Monoman Formation) due to the irrigation mound beneath Renmark, which acts to drive saline water in the Parilla from under Renmark and into the river. Presently, the floodplain between the basin and Ral Ral Creek is highly salinised indicating that saline water is still discharging to the area, long after disposal ceased, suggesting that most of the flow is driven by the irrigation mound. However, the high salinity of the basin (35,000-50,000 EC) while in operation probably also contributed to the problem.

<**Hydraulic linkage to surface runoff**>

<**Category - hydraulic stability**>

<**Category - degree of hydraulic isolation**>

<Site Name> Block 'E' Floodplain
<Synonyms>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Barnett, S.R. (South Australia Department of Mines and Energy), 1991- Renmark Hydrogeologic Map (1:250 000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia

Jacobs, T., and Collingham, E.B., 1984- River Murray Phase II Studies: Berri East Groundwater Interception Scheme: Summary report., South Australia Engineering and Water Supply, EWS 730/84.


N
Bulyong Island
Block E Floodplain
km
1 km

<Site Name> Brilka Creek
<Synonyms> Rufus River Interception Scheme

Spatial

<Location description> 1 kilometre south of Lake Victoria, NSW

<Located in Murray Trench> Yes

<Location 1:250 000> Mildura

<Location 1:100 000> Lindsay 7129

<Zone> 54H

<Coordinates easting (AMG)> 525000

<Coordinates northing (AMG)> 6231000

<State> New South Wales

General

<Year begun operation> 1967

<Active/inactive> Active

<Full surface area (ha)> 200 ha at 22 m AHD

<Volume capacity (ML)>

<Full surface level (m AHD)> 22 m AHD

<Groundwater level (m AHD)> 22.7 m AHD (RWC, 1991)

<Groundwater seepage/discharge> Discharge from mound associated with Lake Victoria

<Average annual evaporation> Inflow/evaporation 1.1 (excess pumped to Meander Loop)

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)> 5,000 mg/L (flooded); mean 10,000-35,000 mg/L (E&WS, 1994)

<Sources of water to be disposed> Groundwater mound from Lake Victoria

<Terminal/throughflow basin> Throughflow (pumped to Meander Loop)

<Range of elevation of lake surface with disposal>

<Lining/treatment of base>

<Review of environmental impacts>

<Site Name> Brilka Creek
<Synonyms> Rufus River Interception Scheme

Engineering/Admin

<Public or private operation> Public

<Agency responsible> SA Engineering and Water Supply and Mid Pike Irrigators

<Project name> Brilka Creek

<Natural, modified natural or constructed> Modified natural

<Modification type and degree>

Geological

<Site description and Geomorphology> Anabranch of the River Murray that now intercepts large volumes of water due the groundwater mound associated with Lake Victoria (E&WS, 1994).

<Subsurface investigations at site>

<Structural setting> The basin is located northeast of the Wentworth Trough and southeast of the Renmark Trough (Barnett, 1991; and RWC, 1991).

<Stratigraphic setting> The basin is floored by the Coonambidgal Formation (3-7 m), and is underlain by the Channel Sand (3-11 m), the Parilla Sand (30-50 m), and the Bookpurnong Beds (Interpreted from RWC, 1991)).

<Host formation> Coonambidgal Formation

<Host lithofacies> Silty clay and clay

<Aquitard> Coonambidgal Formation

<Aquitard lithofacies> Coonambidgal Formation: silty clay and clay

<Aquifer> Channel Sand and Parilla Sand

<Aquifer lithofacies> Channel Sand and Parilla Sand: Medium to coarse quartz sand

<Comments>

Summary of Hydrodynamics

<Distance to Murray or tributary> 1 kilometre

<Head between basin and river/tributary>

<Site Name> Brilka Creek
<Synonyms> Rufus River Interception Scheme

<Direction of groundwater flow in regional aquifer> Southwest towards the river (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Coonambidgal Formation: 3-7 metres

<kv and kh of aquifer>

<EC of aquifer> Parilla Sand: 35,000 to 100,000 mg/L (Barnett, 1991)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 30 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The artificial raising of the water level of Lake Victoria has caused a groundwater mound in the Parilla Sand aquifer to form in excess of 5 metres and has greatly increased the amount of saline groundwater flow towards the Murray River. Brilka Creek by nature of its position between the lake and the river intercepts some of the discharge, preventing it from entering the river. Current inflows exceed the evaporation capacity of the basin and the excess must be pumped to Meander Loop Basin (E&WS, 1994).

<Hydraulic linkage to surface runoff> Connected to the river by an outlet

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Site Name> Brilka Creek
<Synonyms> Rufus River Interception Scheme

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

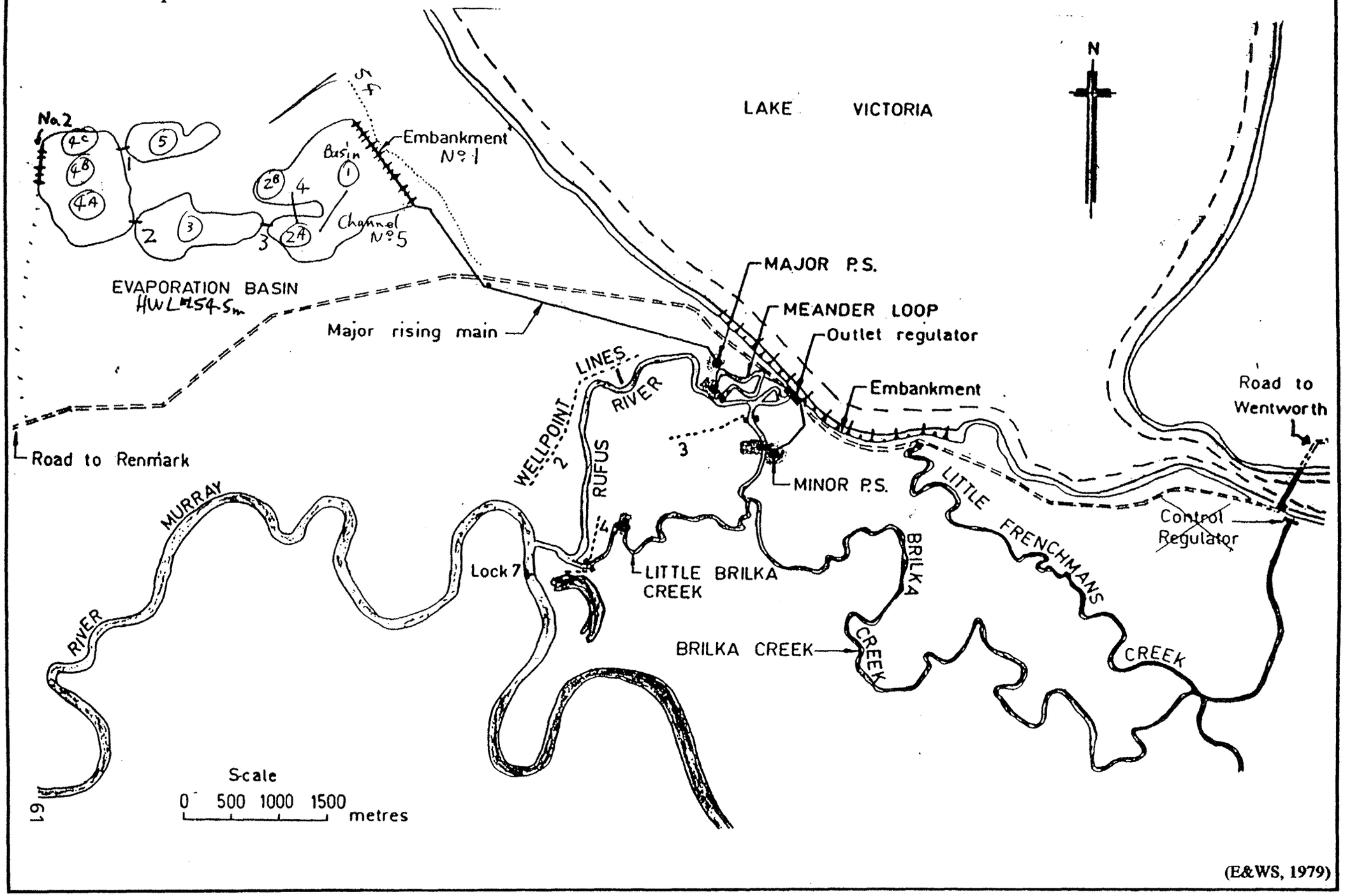
Barnett, S.R. (South Australia Department of Mines and Energy), 1991- Renmark Hydrogeologic Map (1:250 000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

South Australia Engineering and Water Supply (E&WS) 1994- Evaluation of Saline Water Disposal Basins along the River Murray between Lock 1 and Lake Victoria, SA Engineering and Water Supply, Draft 94/1

N
Meander Loop
Brilka Creek
(30/10/1968)

Rufus River Disposal Basin



(E&WS, 1979)

<Site Name> Bulyong Island
<Synonyms>

Spatial

<**Location description**> Adjacent and east of Ral Ral Creek, west of Bulyong Creek, 6.3 kilometres north of Renmark, SA

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Renmark

<**Location 1:100 000**> Renmark 7029

<**Zone**> 54H

<**Coordinates easting (AMG)**> 476500

<**Coordinates northing (AMG)**> 6224500

<**State**> South Australia

General

<**Year begun operation**> 1967

<**Active/inactive**> ceased operation in 1990 (Water now pumped to Disher Creek Disposal Basin)

<**Full surface area (ha)**> 330 ha at 17.60 m AHD

<**Volume capacity (ML)**> 1210 ML at 17.60 m AHD

<**Full surface level (m AHD)**> 17.63 m AHD

<**Groundwater level (m AHD)**> <18 m AHD (Barnett, 1991)

<**Groundwater seepage/discharge**> Groundwater discharge into the Murray River and Ral Ral Creek, during operation from 1967 to 1990

<**Average annual evaporation**> Regional: 2300 mm/yr (Kernich, 1984); Local: 1600-1700 mm/yr (K. Smith, pers. comm.)

<**Volume disposed annually (ML/yr)**> 554 ML in 1985; 696 ML in 1986; 506+ ML in 1987

<**Salinity of water disposed (EC)**> 13,500 mg/L TDS (Beckwith, 1979)

<**Range of salinity in basin (EC)**> 1790 EC (9/88) to 25,300 EC (11/87) (EWS Berri Field Records); 24,000 mg/L TDS (Beckwith, 1979).

<**Sources of water to be disposed**> Emergency use only: CDS water from Chaffey Irrigation Area and Renmark Irrigation Trust (RIT)

<**Terminal/throughflow basin**> Part flushing capacity: during operation 1 in 10 year floods, and since abandonment and partial removal of banks the basin is flooded by 1 in 3 year floods

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> up to 16.89 m AHD (11/87)

<Site Name> Bulyong Island
<Synonyms>

<Review of environmental impacts> Within Murray River National Park. Area is also severely salinised

Engineering/Admin

<Public or private operation> Public

<Agency responsible> SA Engineering and Water Supply

<Project name> Bulyong Island

<Natural, modified natural or constructed> Modified natural

<Modification type and degree> Large banks on west, south, and east sides, one inlet/outlet, flushing spillways.

Geological

<Site description and Geomorphology> The basin is a modified swamp within the Murray Trench, but has been altered to allow the storage of saline water. Salinisation of the soil is very advanced with only a few samphire bushes surviving (EWS, 1989).

<Subsurface investigations at site> 5 auger holes

<Structural setting> The basin is located east of the Hamley Fault, and within the Renmark Trough (Barnett, 1991).

<Stratigraphic setting> The basin is floored by the Coonambidgal Formation (5 m), and underlain by the Monoman Formation (20 m), the Bookpurnong Beds (20-25 m), and the Murray Group Limestone (Collingham, 1971).

<Host formation> Coonambidgal Formation

<Host lithofacies> Grey clay, black silty clay, and yellow puggy silt. There is also a seam of gypsum (0.5 m) under artesian or semi-artesian flow sandwiched between the clays (Collingham, 1971).

<Aquitard> Coonambidgal Formation and Bookpurnong Beds

<Aquitard lithofacies> Coonambidgal Formation: Grey clay, black silty clay, and yellow puggy silt. There is also a seam of gypsum (0.5 m) under artesian or semi-artesian flow sandwiched between the clays (Collingham, 1971). Bookpurnong Beds: Dark grey silt and clay, and very shelly sand

<Aquifer> Monoman Sands and Parilla Sand

<Aquifer lithofacies> Medium to coarse grained quartz sand

<Comments> While active disposal has ceased diversion to Bulyong Island still occurs during times of peak drainage flows or when pump failure occurs (EWS, 1989).

<Site Name> Bulyong Island
<Synonyms>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 35 metres

<**Head between basin and river/tributary**> 0.6 m (Collingham, 1971)

<**Direction of groundwater flow in regional aquifer**> Southeast towards the Murray River (Barnett, 1991)

<**kv of artificial floor**>

<**kv and kh of host**> H-1: Yellow clay silt Kh = 3.8 m/day; RS-1: Yellow puggy silt Kh = 3.1 m/day; F6-1: Multi-coloured clay silts Kh = 4.1 m/day; Trench: Gypsum layer Kh = 1.6 m/day (Collingham, 1971).

<**kv and kh of aquitard**> Coonambidgal Formation: H-1: Yellow clay silt Kh = 3.8 m/day; RS-1: Yellow puggy silt Kh = 3.1 m/day; F6-1: Multi-coloured clay silts Kh = 4.1 m/day; Trench: Gypsum layer Kh = 1.6 m/day (Collingham, 1971).

<**Thickness of aquitard**> Coonambidgal Formation: 5 metres; Bookpurnong Beds: 20-25 metres

<**kv and kh of aquifer**>

<**EC of aquifer**>

<**Porosity of aquifer**>

<**Thickness of aquifer**> Monoman Formation: 5-7 metres; Parilla Sand: 20 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> The clay layer of the Coonambidgal Formation combined with the low head (0.6 m) is thought to limit accession to the Monoman Sands. However within the Coonambidgal Formation, there is a highly permeable gypsum layer that directly feeds saline water (52,000 ppm) into Ral Ral Creek (Collingham, 1971). Since decommissioning, the basin has been lowered so that it is at or below river level, which has acted to stop further seepage into Ral Ral Creek. Ral Ral Creek does still receives discharge, but it is from the Parilla Sand (forms a continuous aquifer with the Monoman Formation) due to accession of irrigation water beneath Renmark.

<**Hydraulic linkage to surface runoff**> The area is regularly flushed by high flows in the Murray River, needing a flow of 80,000 ML/day (1 in 4 years) (EWS, 1989). However, since work was carried out in 1989/90 the basin can be flushed by 45,000 ML/day (1 in 3 years) (K. Smith, pers. comm.)

<**Category - hydraulic stability**>

<Site Name> Bulyong Island
<Synonyms>

<Category - degree of hydraulic isolation> None, gypsum layer in Coonambidgal Formation feeds disposal water into Ral Ral Creek (and thus the Murray River) (Collingham, 1971).

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

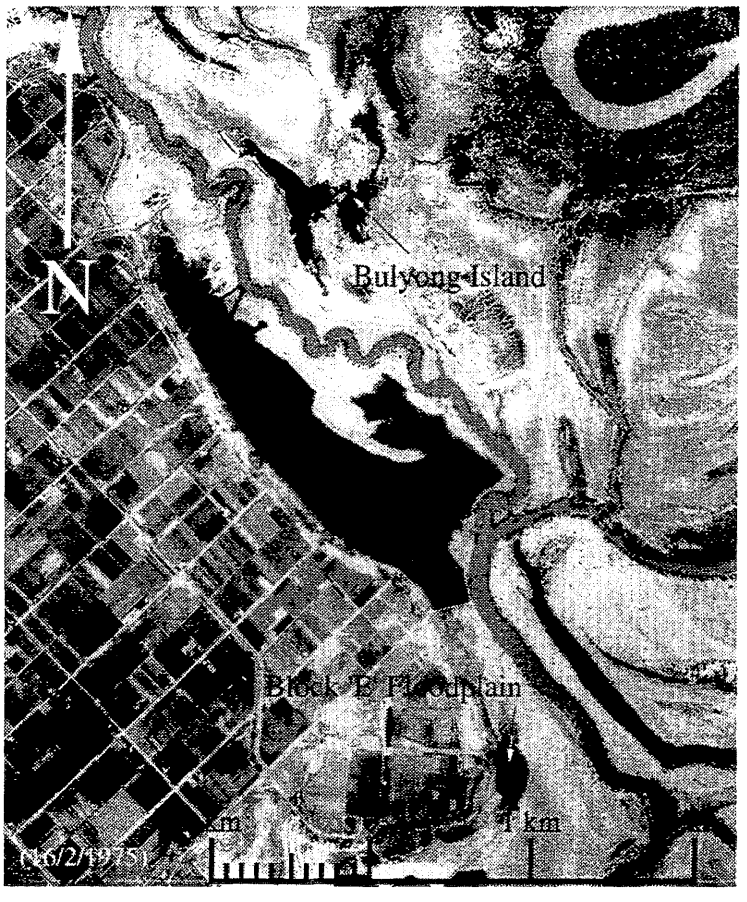
Barnett, S.R. (South Australia Department of Mines and Energy), 1991- Renmark Hydrogeologic Map (1:250 000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia

Beckwith, N.R., 1979- Rehabilitation of Berri-Cobdogla Drainage Scheme: River Murray salinity control: Pipe materials and concrete., South Australia Engineering and Water Supply EWS 849/79

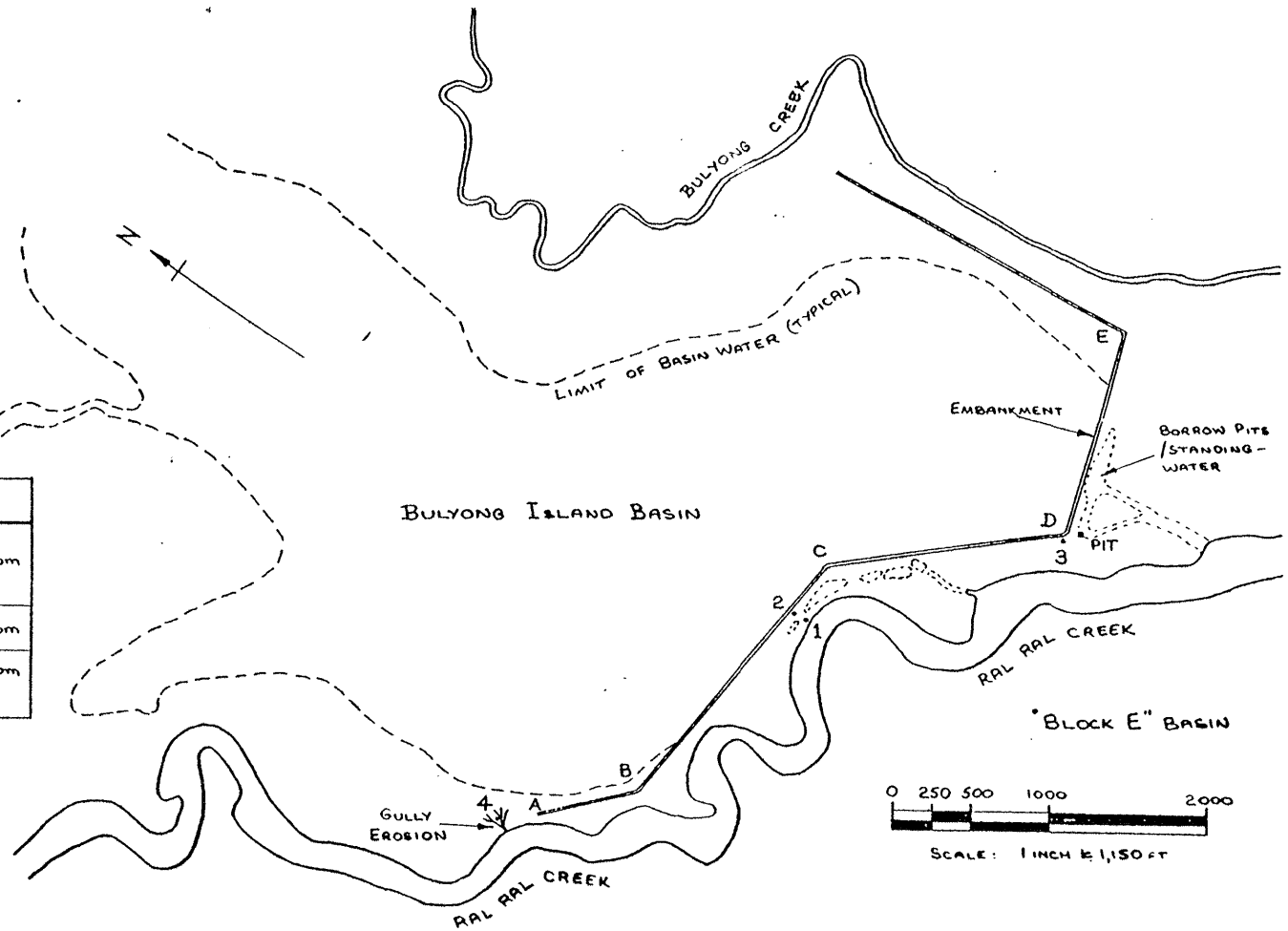
Collingham, E., 1971- Bulyong Island Report., South Australia Engineering and Water Supply Soils and Foundations., Unpublished, EWS 6504/71, 9 p.

Engineering and Water Supply (E&WS) (South Australia), 1989- Enhancing wetlands., South Australian River Murray Wetlands Working Party Report, Engineering and Water Supply Department and Department of Environment and Planning, EWS 1439/88, Report no. 88/7, 174 p.

Kernich, A.M., 1984- The climate of the River Murray and environs, South Australia., Technical report, South Australia Department of Agriculture.

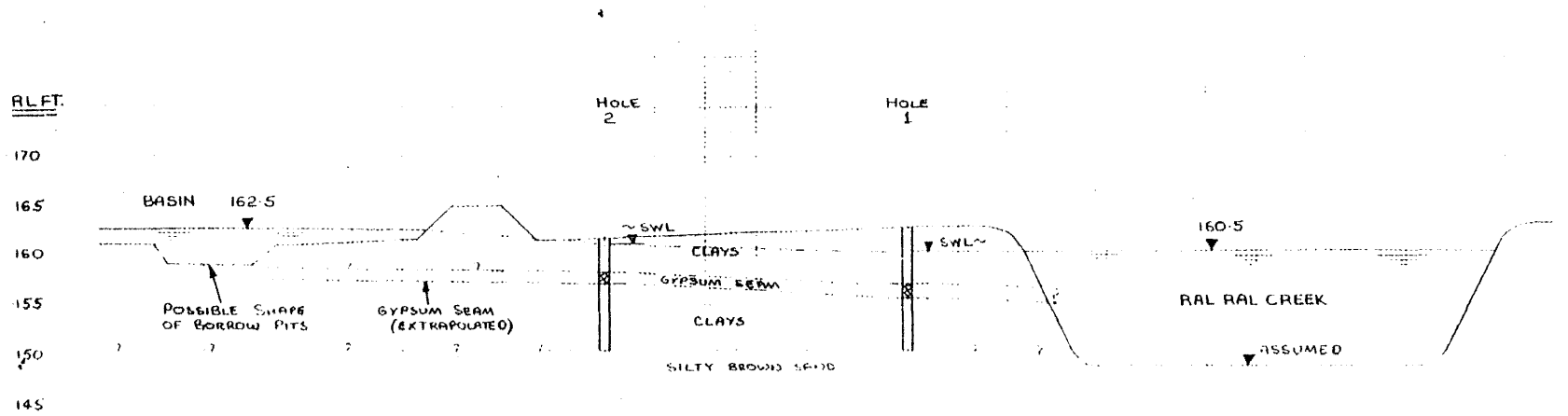

N
Bulyong-Island
Block E Floodplain
1 km
(06/2/1975)

Bulyong Island Evaporation Basin



SALINITY SAMPLES		
HOLE 1	gypsum + sand aquifer mixture	33,000 ppm
HOLE 3	gypsum seam	43,000 ppm
BASIN	1' below surface near point D	22,000 ppm

(Colingham, 1971a)



VERTICAL SCALE 10 mm = 5 FT
HORIZONTAL SCALE 10 mm = 10 FT
VERTICAL EXAGERATION ≒ 2:1

NOTE: SURFACE LEVELS TAKEN FROM R.I.T. PLAN B 67-2

RENMARK AREA - BULYONG ISLAND EVAPORATION BASIN

SECTION LOOKING EAST

FIG 2

SOILS + FOUNDATIONS SECTION
JUNE 1973 E.B.C

(Collingham, 1971a)

<Site Name> Cadell Basin
<Synonyms>

Spatial

<**Location description**> On the floodplain between the Cadell Irrigation Settlement and the River Murray

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Renmark

<**Location 1:100 000**> Morgan 6829

<**Zone**> 54H

<**Coordinates easting (AMG)**> 384700

<**Coordinates northing (AMG)**> 6232100

<**State**> South Australia

General

<**Year begun operation**> 1925

<**Active/inactive**> Active

<**Full surface area (ha)**> 20 ha at 5.9 m AHD

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> 7.42 m AHD?; 8.717 m AHD? related to SM6829-4010; 5.9 m AHD (K. Smith, pers. comm.)

<**Groundwater level (m AHD)**> 4-5 m AHD (Barnett, 1991)

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> 1600-1700 mm/yr (K. Smith, pers. comm.)

<**Volume disposed annually (ML/yr)**> 700 ML/yr

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**> 3000-16,930 EC; average 12,000 EC (E&WS Berri)

<**Sources of water to be disposed**> Comprehensive drainage scheme (CDS) water from Cadell Irrigation Area

<**Terminal/throughflow basin**> Part flushing capacity; ARI of floods 1:4

<**Range of elevation of lake surface with disposal**> 3.14-5.64 m AHD

<**Lining/treatment of base**> None

<**Review of environmental impacts**> Salinisation of floodplain

<Site Name> Cadell Basin
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> SA Engineering and Water Supply

<**Project name**> Cadell Comprehensive Drainage Scheme

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> 2 inlets and 1 outlet

Geological

<**Site description and Geomorphology**> The basin is located on the high floodplain and is surrounded by mallee soil blowover (Woorinen Formation) (Collingham, 1969).

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located east of the Morgan Fault and west of the Hamley Fault (Barnett, 1991).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (or reworked Woorinen Formation), and is underlain by the Coonambidgal Formation (2 m), the Monoman Formation (10 m), the Cadell Marl? (5 m), the Murray Group Limestone (90 m), and the Renmark Group (200 m) (Geology interpreted from Collingham, 1969).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Fine sand and clayey sand

<**Aquitard**> Coonambidgal Formation and Cadell Marl

<**Aquitard lithofacies**> Coonambidgal Formation: Organic sandy clay, clay, and silt; Cadell Marl: Grey fossiliferous marl

<**Aquifer**> Monoman Formation and Murray Group Limestone

<**Aquifer lithofacies**> Monoman Formation: Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 20-100 metres

<Site Name> Cadell Basin
<Synonyms>

<Head between basin and river/tributary> 2-3 metres

<Direction of groundwater flow in regional aquifer> North towards the Murray River (Barnett, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard> Coonambidgal Formation: 0.86 m/day to 8.6 x 10^{-6} m/day (Collingham, 1969)

<Thickness of aquitard> Coonambidgal Formation: 2 metres; Cadell Marl: 5 metres

<kv and kh of aquifer> Monoman Formation: 0.86 m/day (Collingham, 1969); Murray Group Limestone: 1.5-2.5 m/day (Barnett, 1991)

<EC of aquifer> Murray Group Limestone: 14,000-35,000 EC (Barnett, 1991)

<Porosity of aquifer>

<Thickness of aquifer> Monoman Formation: 10 metres; Murray Group Formation: 90 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Because of the 2-3 metre difference between the level of the basin the height of the river, and short horizontal distance (20-100 metres) Cadell Basin has the potential to leak into the river. Collingham (1969), estimated that at 5.9 m AHD the basin would leak at a rate of 363 ML/yr or approximately 51.7% of inflow, which will add about 2900 tonnes/yr of salt to the Murray River. The leakage is confined to the Monoman Formation (and the river) because of the confinement of the Cadell Marl and from the upwards gradient within the Murray Group Limestone. There is also saline input to the river due to the irrigation mound beneath the Cadell Irrigation Area, however it is presently unquantified.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation> Cadell Basin leaks into the Monoman Formation at a rate of 363 ML/yr (Collingham, 1969)

<Evaporation surplus>

<Site Name> Cadell Basin
<Synonyms>

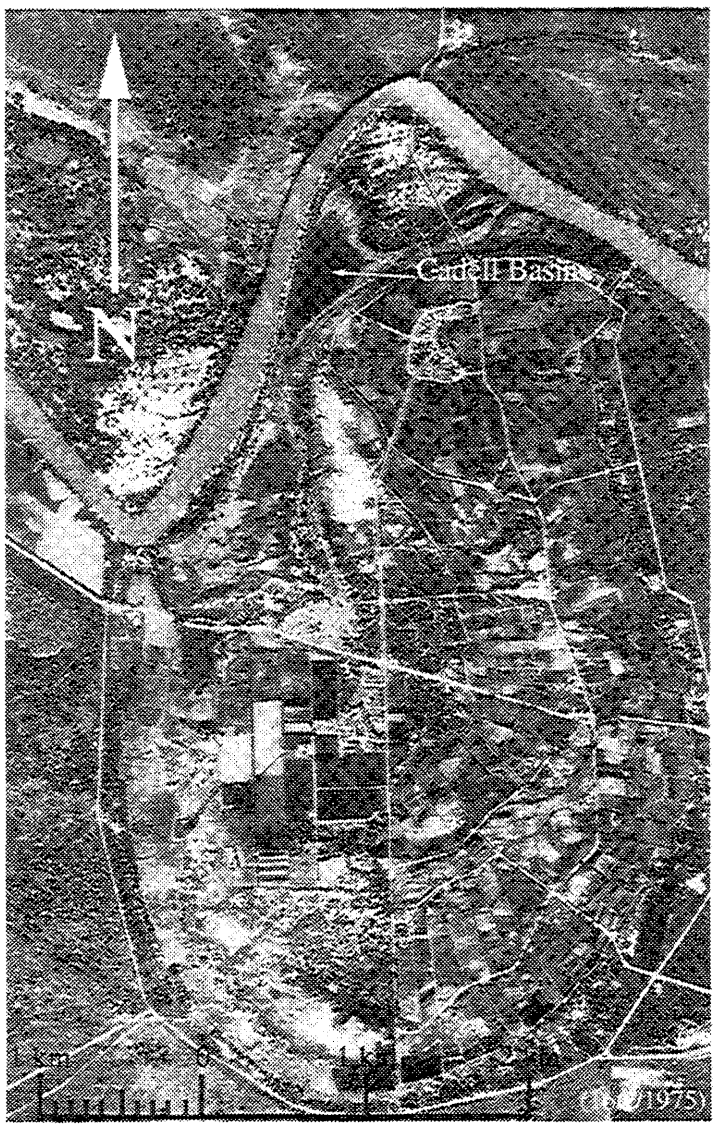
Interpretive 2

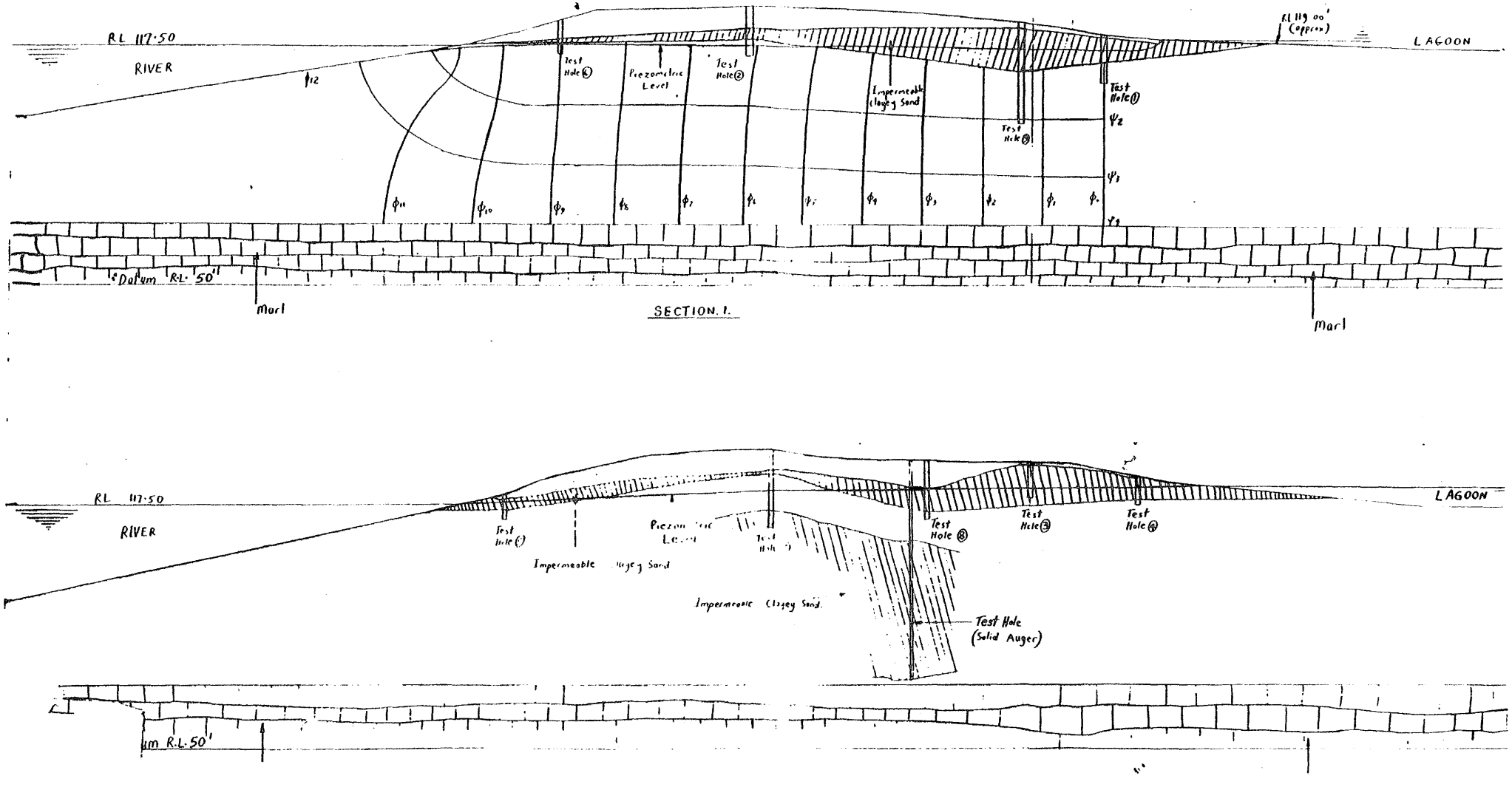
<Ranking of sustainability>

References Cited

Barnett, S.R. (South Australia Department of Mines and Energy), 1991- Renmark Hydrogeologic Map (1:250 000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia

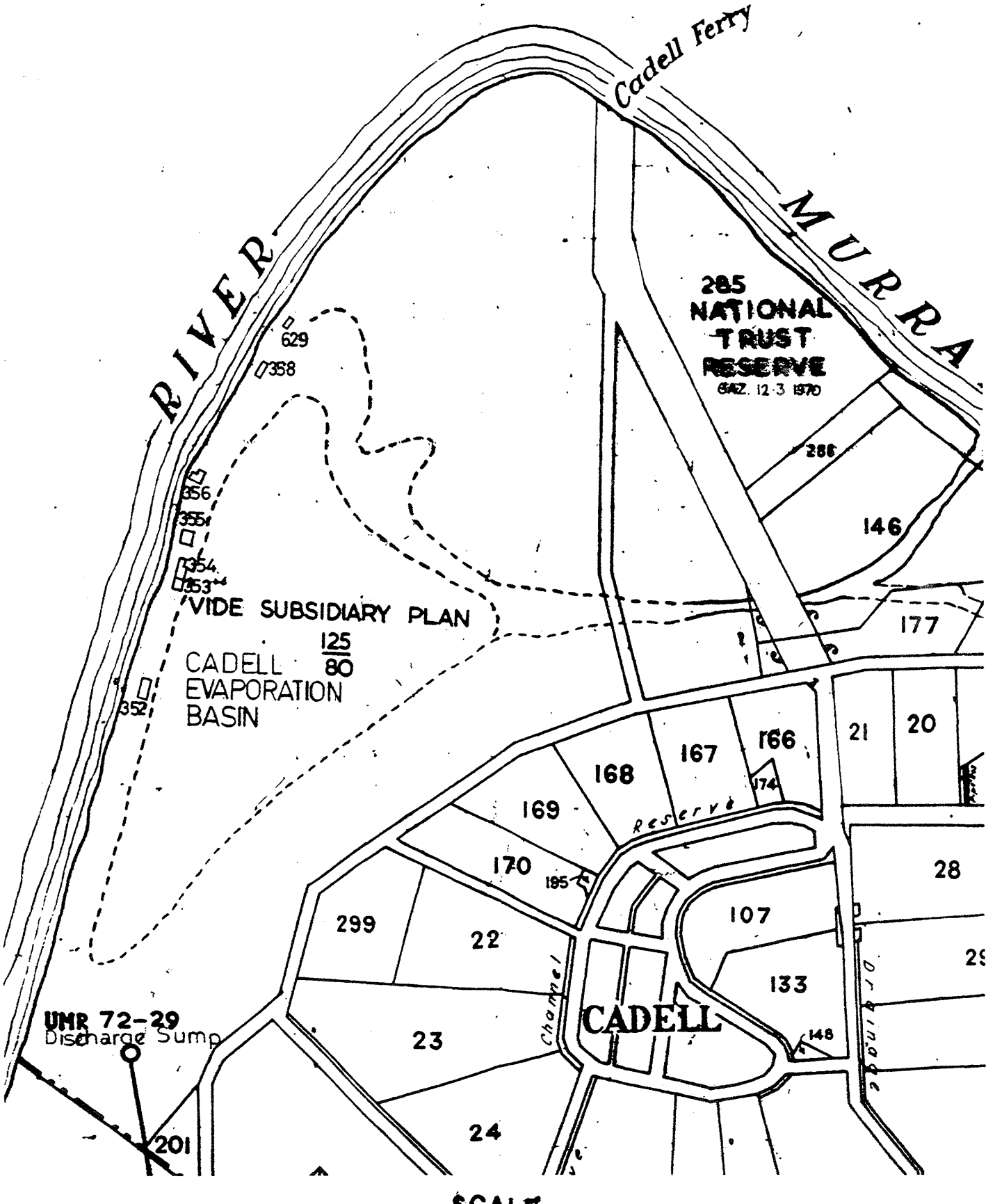
Collingham, E.B., 1969- Cadell Evaporation Basin., South Australia Engineering and Water Supply Department, Unpublished report 991/69


Cadell Basin
N
Km
0
(1975)



(Collingham, 1969)

Cadell Evaporation Basin



(EWS, Adelaide)

<Site Name> Chowilla: Tilmy Dams
<Synonyms> Tilmy Flats

Spatial

<Location description> 31 kilometres NE of Renmark, SA and 17 kilometres east of the New South Wales-South Australia border along the Main Wentworth Road.

<Located in Murray Trench> No

<Location 1:250 000> Renmark

<Location 1:100 000> Chowilla 7030

<Zone> 54H

<Coordinates easting (AMG)> 483000

<Coordinates northing (AMG)> 6250000

<State> South Australia

General

<Year begun operation> Never used (proposed only) tubewells system to be constructed in 1997 (MDBC, 1992).

<Active/inactive> Inactive

<Full surface area (ha)> 200 ha for pumping at 6 ML/day and 100 ha for pumping at 3 ML/day (National Environmental Consultancy, 1987); 1671 ha for Sub-area 3 (Shepherd, 1967)

<Volume capacity (ML)> 46,000 ML

<Full surface level (m AHD)> 51.32 m AHD

<Groundwater level (m AHD)> 17.8 m AHD

<Groundwater seepage/discharge>

<Average annual evaporation> 2200 mm/yr (K. Smith, pers. comm.)

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)>

<Sources of water to be disposed> Series of 15 tubewells intercepting saline groundwater, 10% from Bookpurnong Beds and 90% from Parilla Sand (MDBC, 1992)

<Terminal/throughflow basin>

<Range of elevation of lake surface with disposal>

<Lining/treatment of base>

<Review of environmental impacts>

<Site Name> Chowilla: Tilmy Dams
<Synonyms> Tilmy Flats

Engineering/Admin

<Public or private operation>

<Agency responsible> SA Engineering and Water Supply, Murray Darling Basin Commission, and South Australian Department of Environmental and Natural Resources

<Project name>

<Natural, modified natural or constructed>

<Modification type and degree>

Geological

<Site description and Geomorphology> The proposed basin site is located in an area of cleared and uncleared mallee among the east-west trending Woorinen dunes. There is a mixed region of depressions and ridges that show evidence of deflation cutting through the Blanchetown Clay and mud-cracks that penetrate into the Parilla Sand.

<Subsurface investigations at site>

<Structural setting> On eastern side of Chowilla Fault and the Renmark Trough (Rogers, 1978).

<Stratigraphic setting> The basin is floored by the Woorinen Formation, and is underlain by the Blanchetown Clay (0-15 m), the Parilla Sand (30 m), the Bookpurnong Beds/Winnambool Formation (40 m), the Murray Group Limestone (100 m), and the Renmark Group (200 m) (Shepherd, 1967).

<Host formation> Woorinen Formation

<Host lithofacies> Red silt and sand

<Aquitard> Blanchetown Clay

<Aquitard lithofacies> Clay, silty clay, and sandy clay

<Aquifer> Parilla Sand

<Aquifer lithofacies> Fine to medium sand

<Comments>

Summary of Hydrodynamics

<Distance to Murray or tributary> 7 kilometres to Monoman Creek

<Site Name> Chowilla: Tilmy Dams
<Synonyms> Tilmy Flats

<Head between basin and river/tributary> 30 metres

<Direction of groundwater flow in regional aquifer> South to the Murray River (interpreted from Barnett, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard> Blanchetown Clay: Kv = 8.6 x 10^{-5} m/day (Shepherd, 1967)

<Thickness of aquitard> Blanchetown Clay: 15 metres

<kv and kh of aquifer> Parilla Sand: Kh = 10 m/day (Shepherd, 1967)

<EC of aquifer> Parilla Sand: average 20,000-30,000 mg/L; 60,000 mg/L

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 30 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface> The surface slopes gently to the south towards the River Murray (Shepherd, 1967).

Interpretive 1

<Hydraulic linkage to regional aquifer> In the modelling of the basin Shepherd (1967), assumed a leakage rate from one basin (Basin 8) to be about 4500 ML/yr. Basin 8, was chosen, as it had 'crab holes' or areas of no Blanchetown Clay. He found that after 20 years a mound 9 metres high and 8 kilometress in diameter will have formed, The River Murray is 8 kilometres from the basin, and leakage into the Murray will be on the order of 840 ML/yr along the affected area of the river after 5 years. If the water has average salinity of 30,000 mg/L then salt load to the Murray River would be 250 tons/year or 0.68 tons/day. This rate would be expected to increase the longer the basin was active, and the leakage was for one basin only while Tilmy Dam was to have up to 16 basins (the worst case scenario). Which leads to the conclusion that unless intercepting bores caught the water before it reached the river the basin would have had a short life.

<Hydraulic linkage to surface runoff> None

<Category - hydraulic stability> Water would reach the river within 5 years

<Category - degree of hydraulic isolation>

<Site Name> Chowilla: Tilmy Dams
<Synonyms> Tilmy Flats

<Evaporation surplus> 1980 mm/yr (Evaporation = 2250 mm/yr, Precipitation = 260 mm/yr)

Interpretive 2

<Ranking of sustainability>

References Cited

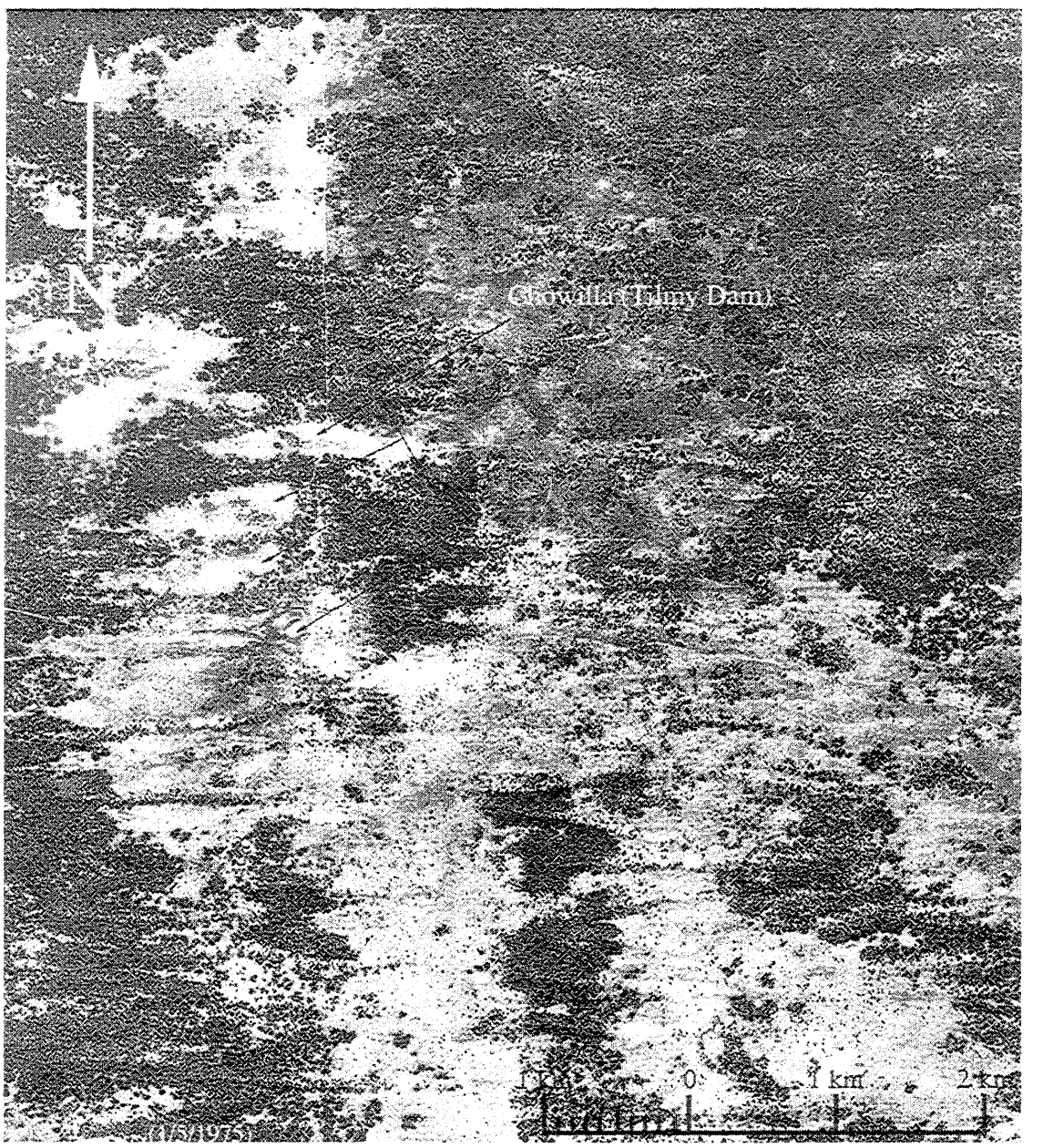
Barnett, S.R. (South Australia Department of Mines and Energy), 1991- Renmark Hydrogeologic Map (1:250 000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia

Murray Darling Basin Commission (MDBC), 1992- Chowilla Resource Management Plan Progress Report, Murray Darling Basin Commission's Chowilla Working Group and Chowilla Reference Group, 33 p.

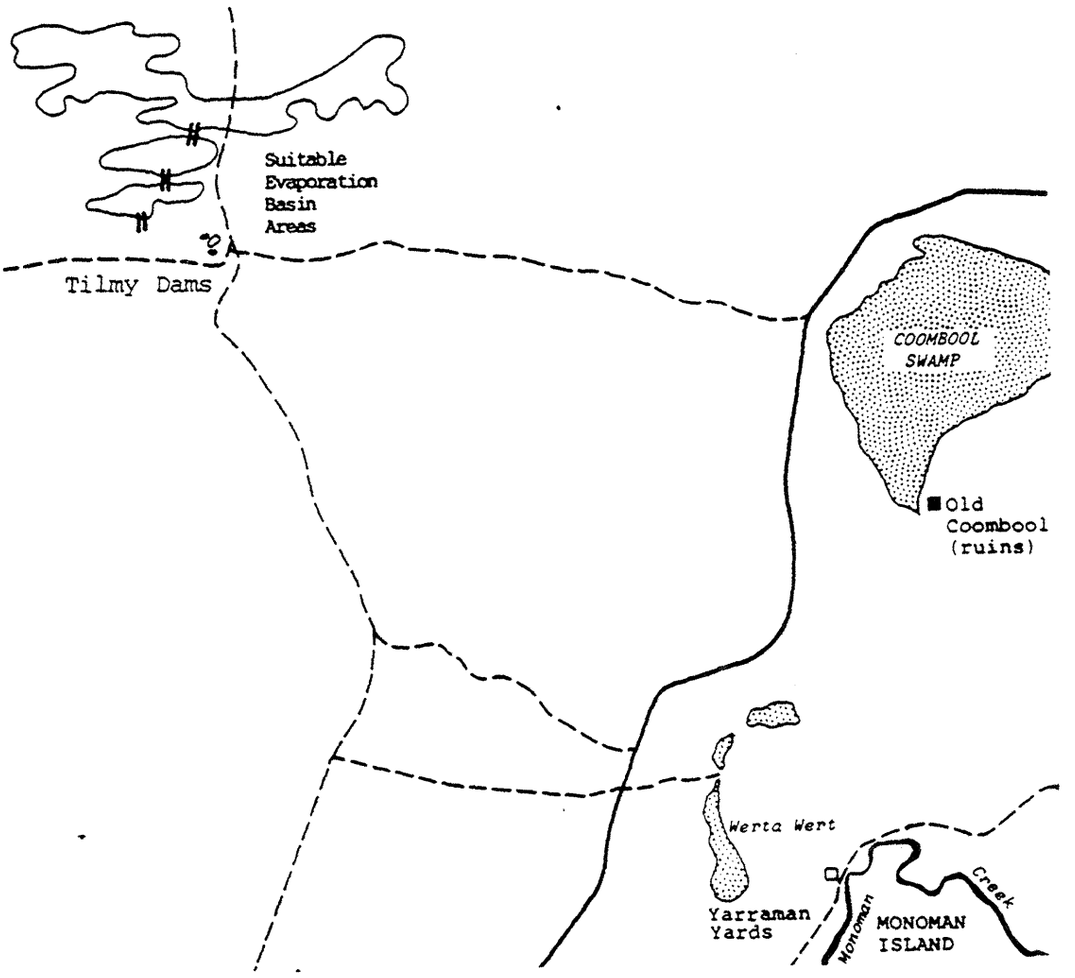
National Environmental Consultancy, 1987- Chowilla Salinity Mitigation Scheme: Draft Environmental Impact Statement, South Australia Engineering and Water Supply,

Rogers, P.A., 1978- Chowilla, South Australia - 1:250 000 Geological Series., Geological Survey of South Australia, Explanatory notes, SI/54-6.

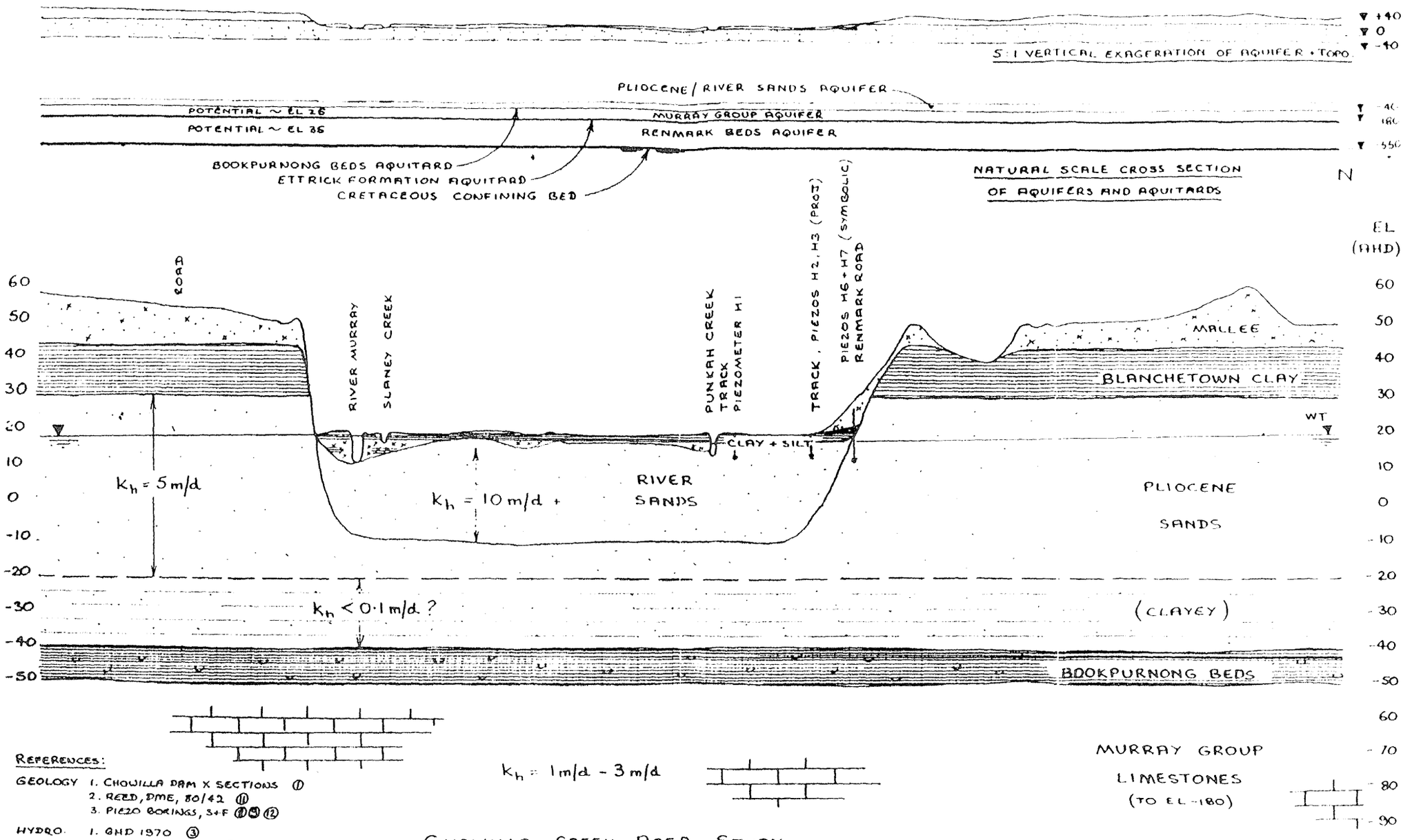
Shepherd, K.J., 1967- Disposal of salt water from Chowilla Dam at Tilmy Flat., South Australia Engineering and Water Supply Department Report 67/8, 17 pp.


Ghowlla (Tilmy Dam)
0
1 km
2 km

Chowilla (Tilmy Dam)



(National Environmental Consultancy, 1987)



REFERENCES:

GEOLOGY
1. CHOWILLA DAM X SECTIONS ①
2. REED, DME, 80/42 ⑪
3. PIEZO BORINGS, S+F ①⑤⑫

HYDRO
1. GHD 1970 ③
2. PD 94, PD 111 ⑤⑦
3. RUFUS RIVER STUDIES, S+F ⑥
4. BERRI EAST STUDY, S+F, ⑬ SUMMARY REF. MAR 1984 ⑭
5. REED 80/42 ⑪
⑧ ⑮ ⑯ ⑰ ⑱

CHOWILLA CREEK AREA STUDY

STYLISED GEOLOGY AND HYDROGEOLOGY ON CROSS SECTION A-A

SCALES 1:50 000 HORIZONTAL, 1:1 000 VERTICAL

(Collingham, 1990)

<Site Name> Cobdogla Evaporation Basin
<Synonyms> Cobdogla Disposal Basin

Spatial

<**Location description**> 1-2 kilometres NNW of Cobdogla, SA on the floodplain east of the Murray River and Chambers Creek.

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Renmark

<**Location 1:100 000**> Moorook 6929

<**Zone**> 54H

<**Coordinates easting (AMG)**> 444500

<**Coordinates northing (AMG)**> 6211500

<**State**> South Australia

General

<**Year begun operation**> 1951

<**Active/inactive**> Active

<**Full surface area (ha)**> 88.4 ha; operational level 30 ha at 10.0 m AHD

<**Volume capacity (ML)**> 63 ML at 10.0 m AHD

<**Full surface level (m AHD)**> 11.19 m AHD

<**Groundwater level (m AHD)**> 10 m AHD (Barnett, 1991)

<**Groundwater seepage/discharge**> Discharge due to irrigation mound

<**Average annual evaporation**> 1600-1700 mm/yr (K. Smith, pers. comm.)

<**Volume disposed annually (ML/yr)**> 260 ML/yr

<**Salinity of water disposed (EC)**> 10,000-30,000 EC

<**Range of salinity in basin (EC)**> 8000-74,700 EC (7/89); 133,000 EC (currently), up to 155,000 EC (E&WS, 1989)

<**Sources of water to be disposed**> Cobdogla Division of Cobdogla Irrigation Area, Comprehensive Drainage System (CDS) water.

<**Terminal/throughflow basin**> Partly flushing ARI of floods 1:5

<**Range of elevation of lake surface with disposal**> 9.86-11.15 m AHD

<**Lining/treatment of base**> None

<**Review of environmental impacts**> The area around the basin is highly salinised with numerous dead trees. Flushing into the Murray River does not currently occur although the basin is inundated at river flows from 75,000-80,000 ML/day (1 in 4 years) (E&WS, 1989). Also ARI 1:5 (60,000 ML/day?) (K. Smith, pers. comm.) A community group has formed to work at the rehabilitation of the area.

<Site Name> Cobdogla Evaporation Basin
<Synonyms> Cobdogla Disposal Basin

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> SA Engineering and Water Supply

<**Project name**> Cobdogla Irrigation Area Comprehensive Drainage Scheme

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Banked off from Chambers Creek, has flushing pipe under causeway and headwall at 11.473 m AHD.

Geological

<**Site description and Geomorphology**> Cobdogla Evaporation Basin is located on the River Murray floodplain. The floodplain is a complex of streams and billabongs separated by banks and levees with direct connection to the Murray via Chambers Creek.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located east of the Hamley Fault within the Renmark Trough (Barnett, 1991).

<**Stratigraphic setting**> The basin is floored by the Coonambidgal Formation (5 m), and underlain by the Monoman Formation (10-20 m), the Bookpurnong Beds/Winnambool Formation (20 m), the Murray Group Limestone (110 m), and the Renmark Group (250 m) (Geology interpreted from Barnett, 1991).

<**Host formation**> Coonambidgal Formation

<**Host lithofacies**> Organic silty sands, clay, and silt

<**Aquitard**> Coonambidgal Formation and Bookpurnong Beds/Winnambool Formation

<**Aquitard lithofacies**> Coonambidgal Formation: Organic silty sands, clay, and silt; Bookpurnong Beds/Winnambool Formation: Dark grey silt and clay, and very shelly sand

<**Aquifer**> Monoman Formation and Murray Group Limestone

<**Aquifer lithofacies**> Monoman Formation: Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> <500 m

<**Head between basin and river/tributary**> 11.19 (Basin) - 10.408 (Chambers Creek) = 0.782 m; The basin is now maintained at or below the level of the river since the establishment of Loveday Basin in 1972 to take the bulk of water from the Cobdogla Comprehensive Drainage Scheme.

<Site Name> Cobdogla Evaporation Basin
<Synonyms> Cobdogla Disposal Basin

<Direction of groundwater flow in regional aquifer> West towards the Murray River induced by the groundwater mound beneath the Barmera-Berri Irrigation Areas (Barnett, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Coonambidgal Formation: 5 metres; Bookpurnong Beds/Winnambool Formation: 20 metres

<kv and kh of aquifer>

<EC of aquifer> Monoman Formation: 35,000 to 100,000 mg/L TDS (Barnett, 1991)

<Porosity of aquifer>

<Thickness of aquifer> Monoman Formation: 10 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Prior to the establishment of Loveday Basin in 1972, the full level of Cobdogla Disposal Basin was kept above the height of the river, which induced downwards leakage from the basin into the Monoman Sand (and thus the Murray River). Presently, the basin is held at or below the level of the river greatly reducing seepage from the basin which has allowed the floodplain vegetation to re-establish itself. The floodplain is however, still receiving discharge from the groundwater mound beneath Barmera, which acts to retard regrowth and regeneration of the area. The salinity of the basin is currently maintained by periodic flushing during high river flows although it can become very saline between floods (133,000 EC) (E&WS, 1989).

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

<Site Name> Cobdogla Evaporation Basin
<Synonyms> Cobdogla Disposal Basin

Interpretive 2

<Ranking of sustainability>

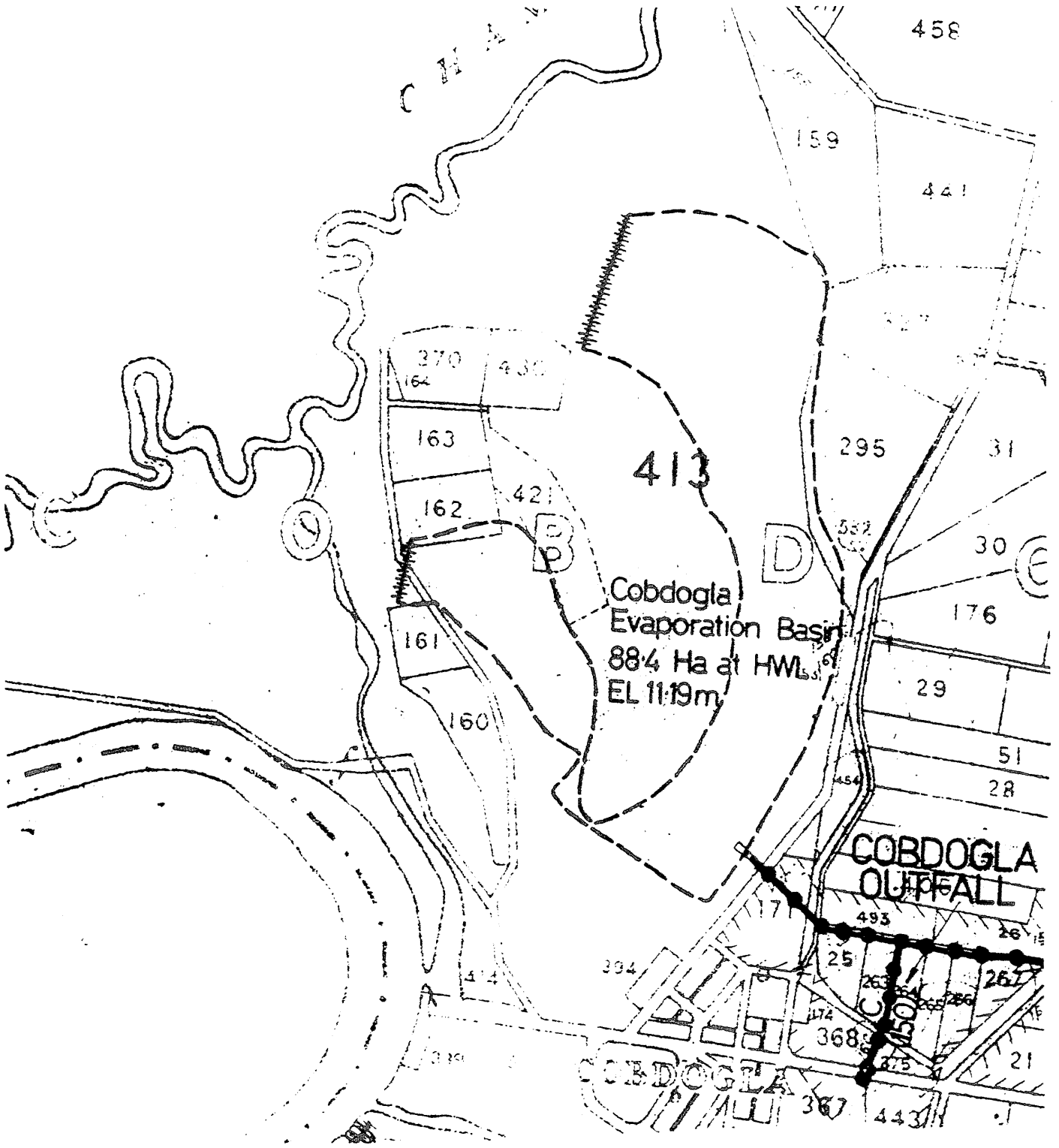
References Cited

Barnett, S.R. (South Australia Department of Mines and Energy), 1991- Renmark Hydrogeologic Map (1:250 000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia

Engineering and Water Supply (E&WS) (South Australia), 1989- Enhancing wetlands., South Australian River Murray Wetlands Working Party Report, Engineering and Water Supply Department and Department of Environment and Planning, EWS 1439/88, Report no. 88/7, 174 p.


1 km
0
1 km
2 km

Cobdogla Evaporation Basin



(EWS, Adelaide)

<Site Name> Cooltong Drainage Disposal Basin
<Synonyms>

Spatial

<**Location description**> 2 kilometres NNW of Cooltong in Chaffey Irrigation Area north of Renmark

<**Located in Murray Trench**> No

<**Location 1:250 000**> Renmark

<**Location 1:100 000**> Renmark 7029

<**Zone**> 54H

<**Coordinates easting (AMG)**> 469250

<**Coordinates northing (AMG)**> 6230350

<**State**> South Australia

General

<**Year begun operation**> 1956

<**Active/inactive**> Active

<**Full surface area (ha)**> 50 ha in 1985-86; Total area = 80.9 ha at 21 m AHD

<**Volume capacity (ML)**> 2468 ML

<**Full surface level (m AHD)**> 20.84 m AHD (EWS Berri); 19.1 m AHD (Smith and Collingham, 1988)

<**Groundwater level (m AHD)**> River pool level = 16.3 m AHD; >18 m AHD (Barnett, 1991)

<**Groundwater seepage/discharge**> Seepage towards salinas to the north

<**Average annual evaporation**> 760 ML/year in 1985-86 or 1520 mm/yr (Smith and Collingham, 1988)

<**Volume disposed annually (ML/yr)**> 903 ML (1985-86) (Smith and Collingham, 1988); 832 ML/yr (1987) (Smith and Watkins, 1993)

<**Salinity of water disposed (EC)**> 3300 EC

<**Range of salinity in basin (EC)**> 12,900 to 24,900 EC in 1985-86

<**Sources of water to be disposed**> Drainage water from Cooltong Division of the Chaffey Irrigation area

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**> 18.82 to 19.15 m AHD in 1985-86

<**Lining/treatment of base**> None

<**Review of environmental impacts**> The infiltration displaces saline water into Ral Ral Creek causing an increase in salinity at the pickup station for Chaffey Irrigation Area (Smith and Collingham, 1988).

<Site Name> Cooltong Drainage Disposal Basin
<Synonyms>

Engineering/Admin

<**Public or private operation**> Private

<**Agency responsible**> Local irrigators, but overseen by SA Engineering and Water Supply

<**Project name**> Cooltong Drainage Disposal Basin (Chaffey Irrigation Area)

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**>

Geological

<**Site description and Geomorphology**> Cooltong is a deflation basin located amongst the longitudinal Woorinen dunes located on the upper Murray Basin floodplain (Rufus Terrace?).

<**Subsurface investigations at site**> 10 bores

<**Structural setting**> The basin is located east of the Hamley Fault and within the Renmark Trough (Barnett, 1991).

<**Stratigraphic setting**> Cooltong Basin is floored by the Yamba Formation (although surrounded by Woorinen Formation), and underlain by the Blanchetown Clay (5 m) (lithology and position suggests that it could instead be the Rufus Formation), the Lower Loxton Sand (10-15 m), the Bookpurnong Beds (5 m), the Murray Group (110 m), and the Renmark Group (Geology interpreted from Collingham, 1991)

<**Host formation**> Yamba Formation

<**Host lithofacies**>

<**Aquitard**> Blanchetown Clay (Rufus Formation?) and Bookpurnong Beds

<**Aquitard lithofacies**> Blanchetown Clay: Calcareous, pale brown, grey mottled red brown clay with a trace of fine sand; Bookpurnong Beds: Dark grey shelly clay

<**Aquifer**> Loxton-Parilla Sand

<**Aquifer lithofacies**> Fine to coarse grained sand with a touch of clay in places. Vividly coloured in a variety of hue: i.e. ochre, yellow, orange, red, pink, dark brown, and grey (Collingham, 1991).

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 3 kilometres to Ral Ral Creek

<**Head between basin and river/tributary**> 2.5 metres

<**Direction of groundwater flow in regional aquifer**>

<Site Name> Cooltong Drainage Disposal Basin
<Synonyms>

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard> Bookpurnong Beds: Kv = 1 x 10^{-8} m/day (E. Collingham, pers. comm.)

<Thickness of aquitard> Blanchetown Clay: 4-7 m; Bookpurnong Beds: 5-7 metres

<kv and kh of aquifer> Lower Loxton Sand: Kh = 0.5 m/day (E. Collingham, pers. comm.)

<EC of aquifer> 20,000-55,000 EC (Collingham, 1991)

<Porosity of aquifer>

<Thickness of aquifer> Lower Loxton Sand: 20 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Cooltong is a deflation basin that formed on a high terrace on the mallee/trench boundary. It may have formed from either flow within the perched aquifer, that collected in a depression at the edge of the trench and then deflated through the Woorinen Formation (Blanchetown Hypothesis); or it may have formed due to recharge in the Parilla Sand from the trench escarpment that surfaced at the edge of the trench (the contact between the escarpment and the Rufus Formation) forming a lake, and leading to deflation (Rufus Hypothesis). The choice of a model may affect the development of management practices to prevent water entering the Murray River.

The basin is estimated to leak at a rate of 140 ML/year or 16% of inflow (Smith and Collingham, 1988). Ninety percent of infiltration is though to be in the perched aquifer (Woorinen Formation), which flows northwards and discharge into the swamps, north of Cooltong (there is almost no flow into Ral Ral Creek). The rest of the infiltration (10% which is 2% of inflow or about 18 ML/yr) is thought to pass through the Blanchetown Clay and enter the regional aquifer (Collingham, 1991). It is unclear if the leakage from the basin is low because of the irrigation mound beneath Renmark I.A. keeps the groundwater mound (>18 m AHD) at about the same height as the basin (eliminating the downward potential), the presence of the Blanchetown Clay aquitard, or a combination of the two. Regardless, the effect of the seepage is low compared with the much greater inflow into the Parilla Sand from the irrigation mound.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> Cooltong Drainage Disposal Basin
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

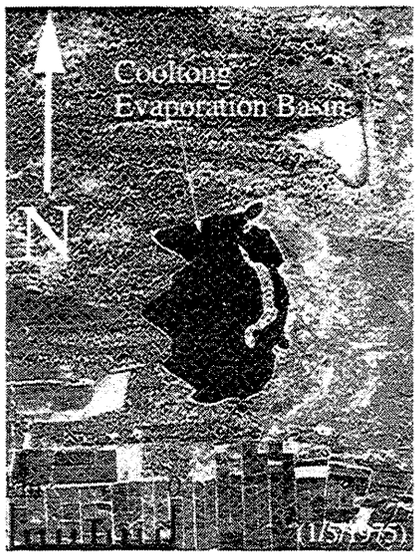
References Cited

Collingham, E.B., 1991- Cooltong Drainage Disposal Basin: A study of its hydrogeologic performance and impact on Ral Ral Creek., South Australia Engineering and Water Supply Engineering Services Branch, unpublished.

Engineering and Water Supply Department (E&WS) (South Australia), 1983- Chaffey Irrigation Area: Review of rehabilitation scheme for irrigation headworks., EWS 82/46.

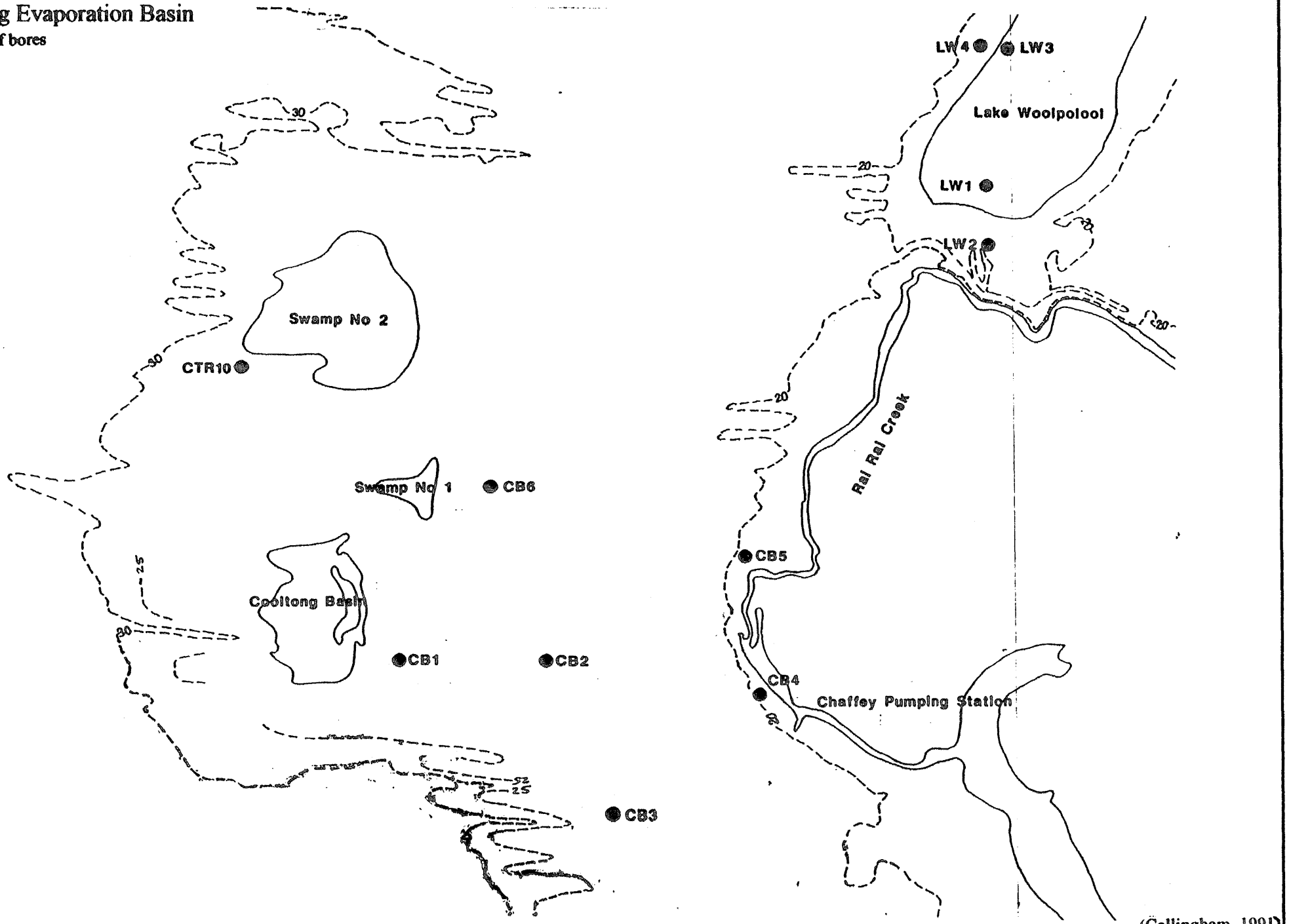
Smith, K.G., and Collingham, E.B., 1988- Cooltong Drainage Disposal Basin: Calculation of loss of water by infiltration and evaporation, South Australia Engineering and Water Supply, Unpublished.

Smith, K.G., and Watkins, N., 1993- Border to the Barrages - Natural resource criteria for sustainable irrigation on the River Murray., River Murray Water Resources Committee, 100 p.


Coolrong
Evaporation Basin
N
(15/1975)

Cooltong Evaporation Basin

Location of bores



(Collingham, 1991)

<Site Name> Disher Creek Basin
<Synonyms>

Spatial

<**Location description**> 9 kilometres SSW of Renmark, SA, in the Murray River National Park adjoining the Murray River in the east and Disher Creek along the western margin.

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Renmark

<**Location 1:100 000**> Renmark 7029

<**Zone**> 54H

<**Coordinates easting (AMG)**> 472000

<**Coordinates northing (AMG)**> 6211000

<**State**> South Australia

General

<**Year begun operation**> 1967

<**Active/inactive**> Decommissioned for disposal in 1983 when Noora Basin commenced operation; and has since operated as a balancing storage basin

<**Full surface area (ha)**> 150 ha (30% of original basin (500 ha) (E&WS, 1989e); Presently 100 ha at 13.4 m AHD

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> 15.80 m AHD; since 1983 pool level is 13.2 m AHD

<**Groundwater level (m AHD)**> 13.4 m AHD

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> Regional: 2550 mm/yr (Kernich, 1984); Local: 1600-1700 mm/yr (K. Smith, pers. comm.)

<**Volume disposed annually (ML/yr)**> 1797 ML/year average (1989-93), 2600 ML/yr (Smith and Watkins, 1993); Currently 4400 ML/yr inflow, with 1100 ML evaporation and the rest pumped to Noora or released to the river during high flows

<**Salinity of water disposed (EC)**> 10,750 mg/L? outfall value from basin

<**Range of salinity in basin (EC)**> 310 average. 12,567 EC (7540 mg/L in 1985)

<**Sources of water to be disposed**> Renmark Irrigation Trust, Renmark Area Drainage Disposal Scheme (RADDS), Renmark Reservoir, and the Ral Ral Division of the Chaffey Irrigation Area

<**Terminal/throughflow basin**> Throughflow but flushed at high river; pumps to Noora; ARI of floods 1:2.5

<**Range of elevation of lake surface with disposal**> pump high water level 15.2 m AHD; low water level 12.15 m AHD

<**Lining/treatment of base**> None

<Site Name> Disher Creek Basin
<Synonyms>

<**Review of environmental impacts**> Severe salinisation and degradation during period 1967 to 1983 when the basin operated at a higher level. Post Noora, and recent flushing by the river during high flows has seen significant recovery (K. Smith, pers. comm.).

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> SA Engineering and Water Supply

<**Project name**> Disher Creek Evaporation Basin

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> 1 inlet/outlet, flushing spillways

Geological

<**Site description and Geomorphology**> The basin is located on the Murray River floodplain, it is surrounded by high level terraces to the north and west, and is bordered by the river on the south and east. Adjacent to the high ground is the Disher Creek channel which with another channel cuts across the basin, but generally tends to parallel the river. Both channels are deeply incised into the Coonambidgal Formation (clay), and cut through into the Monoman Formation. Within the basin the geomorphology is mostly point bar deposits (Collingham, 1971b).

<**Subsurface investigations at site**> 7 piezometers, and 11 trenches

<**Structural setting**> The basin sits in the Loxton Basin within the Paringa Embayment of South Australia (Firman, 1972).

<**Stratigraphic setting**> The basin is floored by the Coonambidgal Formation (3 m), and is underlain by the Monoman Formation (20-25 m), the Loxton-Parilla Sand (5 m), Bookpurnong Beds (10 m), the Winnambool Formation (15 m), the Murray Group Limestone (100 m), and the Renmark Group (Collingham, 1971b; Watkins, 1992d).

<**Host formation**> Coonambidgal Formation

<**Host lithofacies**> Black clay and silty clay (Collingham, 1971b)

<**Aquitard**> Bookpurnong Beds and Winnambool Formation

<**Aquitard lithofacies**> Bookpurnong Beds: Dark grey silt clay; Winnambool Formation: grey marl

<**Aquifer**> Monoman Sand and Loxton-Parilla Sand

<**Aquifer lithofacies**> Monoman Formation and Loxton-Parilla Sand: Clean, white, coarse sand fining upwards to fine sand (Collingham, 1971b)

<**Comments**>

<Site Name> Disher Creek Basin
<Synonyms>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 20 to 250 metres

<**Head between basin and river/tributary**> 1.5 metres from 1967 to 1983, currently kept at or below mean river level

<**Direction of groundwater flow in regional aquifer**> South towards the Murray River (Barnett, 1991)

<**kv of artificial floor**>

<**kv and kh of host**> Coonambidgal Formation: Kv = 0.18 m/d (Collingham, 1971b)

<**kv and kh of aquitard**> Bookpurnong Beds: Kv = 9×10^{-6} m/d (Collingham, E.B., pers. comm.), 10^{-4} to 10^{-5} m/d (Watkins, 1992d)

<**Thickness of aquitard**> Bookpurnong Beds and Winnambool Formation: 25 metres

<**kv and kh of aquifer**> Monoman Kv = 8.64 m/d (Collingham, 1971b; Test may not be accurate because of hole collapse); Loxton-Parilla Sand 0.5 to 1.5 m/d, Lower Loxton Sand maybe less than 0.1 m/d (Watkins, 1992d).

<**EC of aquifer**> Loxton-Parilla Sand: 17,000-42,000 mg/L

<**Porosity of aquifer**>

<**Thickness of aquifer**> Monoman Formation: 20 metres; Loxton-Parilla Sand: 5 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> During the operation of the basin as a disposal site from 1967 to 1983, the mound formed by the evaporation basin pushed high salinity water in the Parilla Sand (42,000 mg/L) into the Murray River (Collingham, 1971b).

<**Hydraulic linkage to surface runoff**> Disposal water leaks directly into creeks and channels within 250 metres of the basin (Collingham, 1971b).

<**Category - hydraulic stability**> The basin caused (during operation from 1967 to 1983) saline water from two sources to be introduced into the Murray River. The first, was leakage direct from the basin into creeks and channels within 250 metres of the basin. This flow (17,000 mg/L) was concentrated over relatively short fronts, but at high rates of discharge. The second source was due to the mound of the evaporation basin, pushing high salinity water (42,000 mg/L) from the regional aquifer (Loxton-Parilla Sand) into creeks greater than 250 metres away, in a ragged front depending on the hydraulic conductivity of the Coonambidgal Formation. Thus, flow was at a low rate, but over a large area. Because of the high rate of leakage, it was recommended that the basin be

decommissioned (Collingham, 1971b). Since the basin has been decommissioned and the disposal water has been pumped to Noora Disposal Basin, Disher Creek has been kept at or below river level eliminating any problems.

<**Category - degree of hydraulic isolation**> See hydraulic stability

<**Evaporation surplus**>

Interpretive 2

<**Ranking of sustainability**>

References Cited

Barnett, S.R. (South Australia Department of Mines and Energy), 1991- Renmark Hydrogeologic Map (1:250 000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia

Collingham, E.B., 1971b- Dishers Creek Evaporation Basin., South Australia Engineering and Water Supply Department, EWS 6505/71, 2 p., unpublished

Engineering and Water Supply Department (E&WS) (South Australia), 1989e- Visit to Disher Creek Evaporation Basin in South Australia: Visit by the Hon. Bob Hawke, AC, MP Prime Minister of Australia, July 20, 1989., EWS

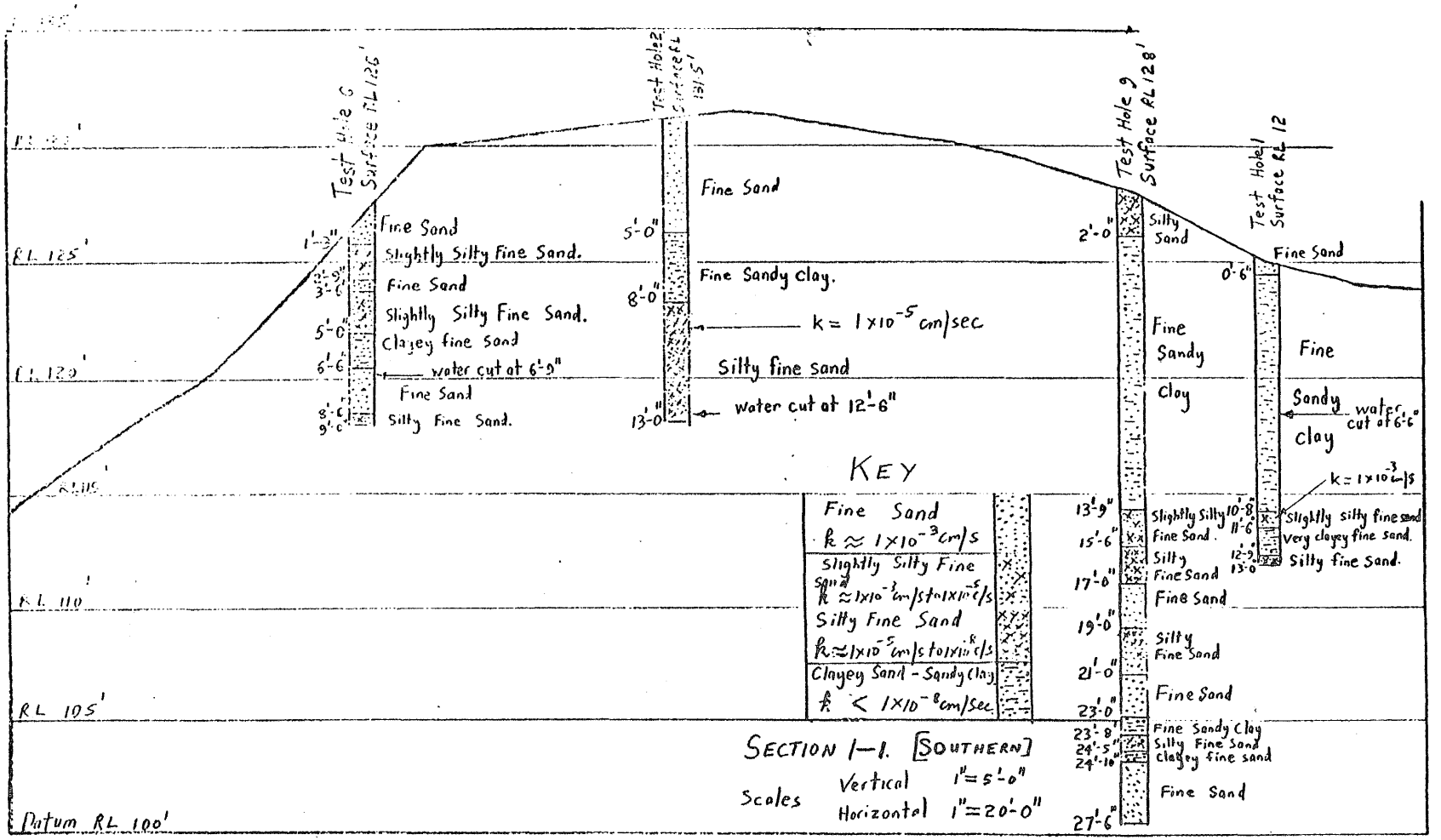
Firman, J.B., 1972- Renmark, South Australia - 1:250 000 Geological Series., Geological Survey of South Australia, Explanatory notes, SI/54-10.

Kernich, A.M., 1984- The climate of the River Murray and environs, South Australia., Technical report, South Australia Department of Agriculture.

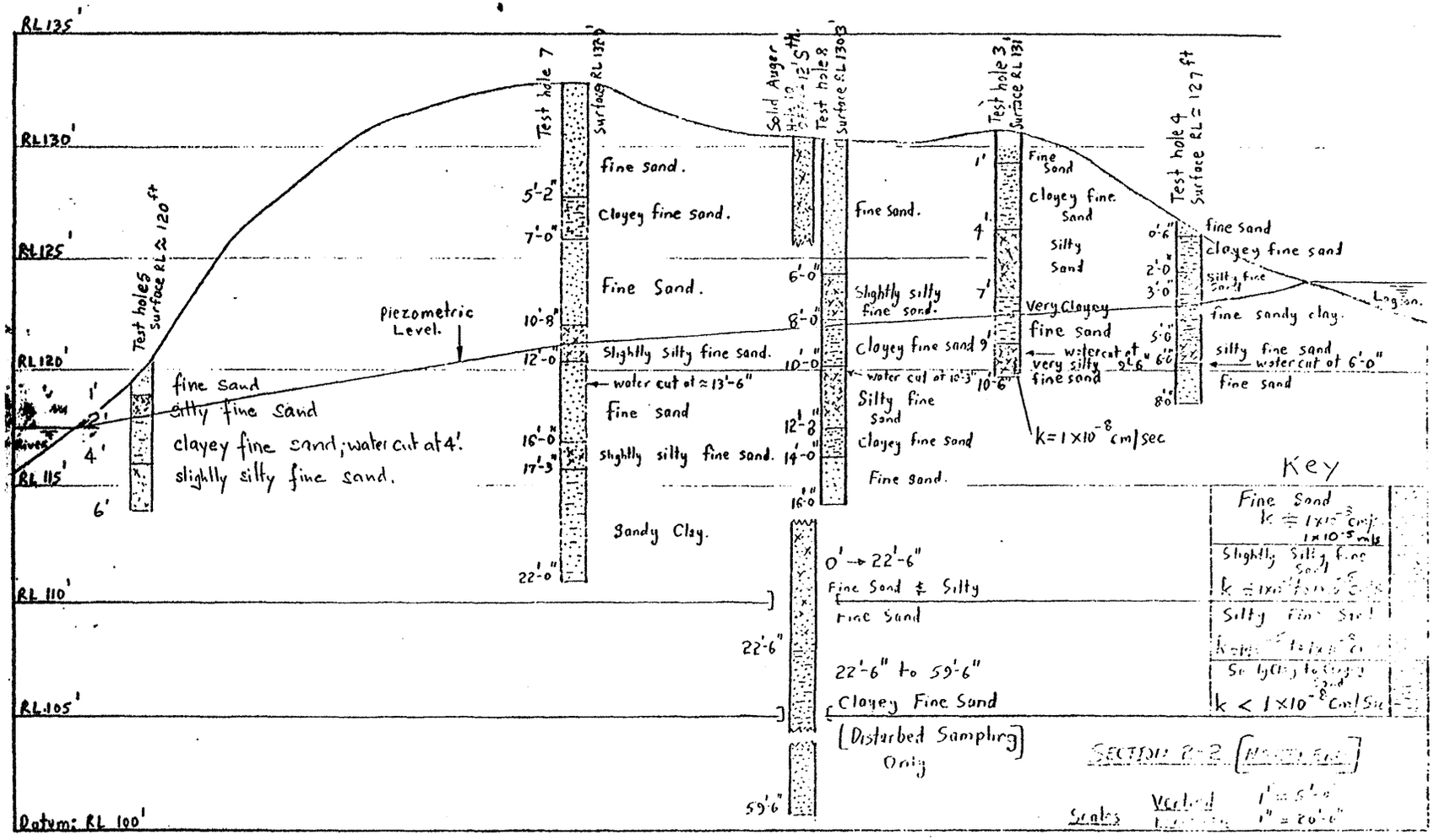
Smith, K.G., and Watkins, N., 1993- Border to the Barrages - Natural resource criteria for sustainable irrigation on the River Murray., River Murray Water Resources Committee, 100 p.

Watkins, N., 1992d- Loxton salinity and drainage investigation status report on hydrogeology., Murray Darling Basin Commission, EWS 92/20, 8 p.


N
Disher Creek Basin
0
1 km
2 km
(16/2/1975)

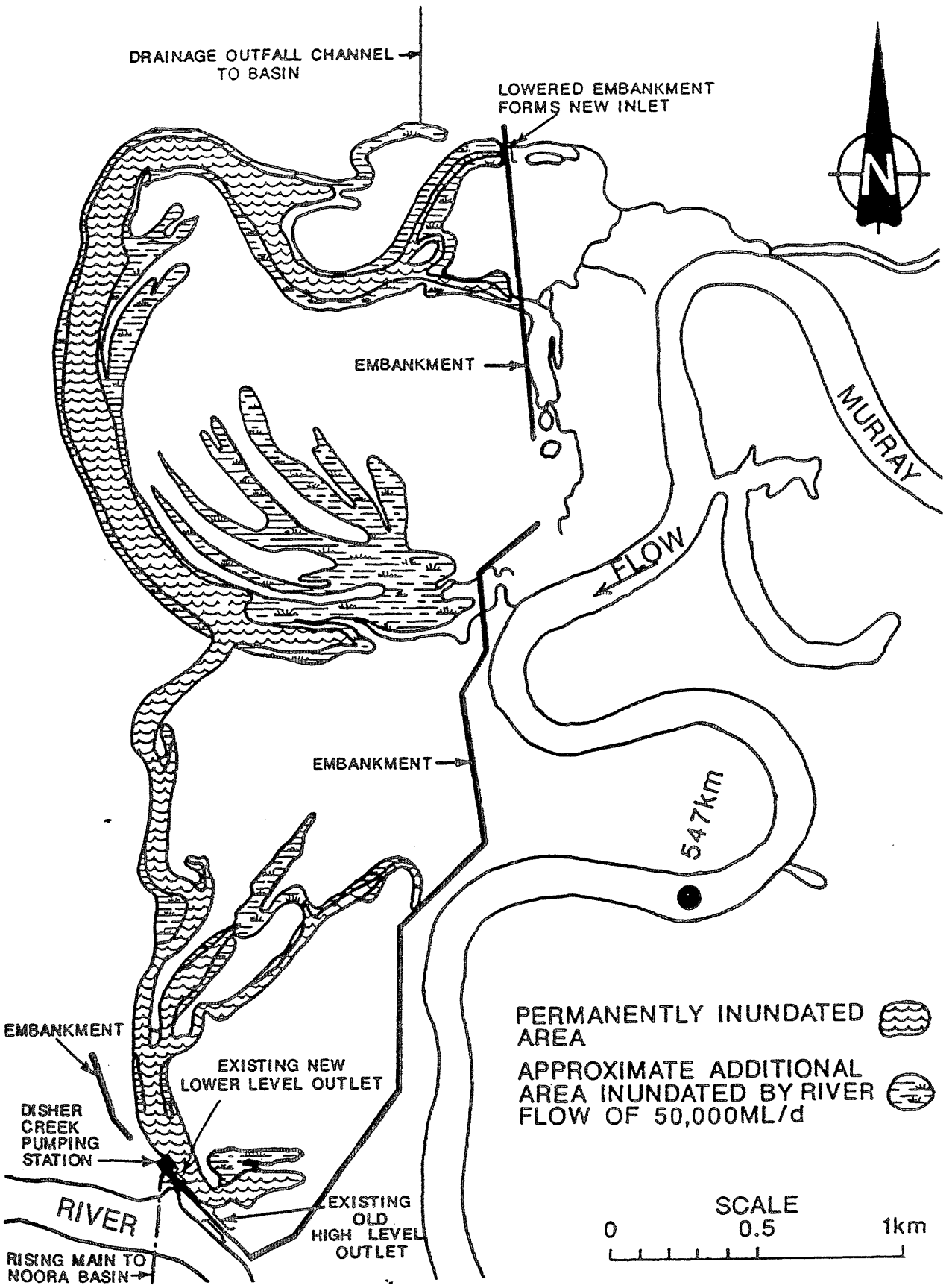


(Collingham, 1971b)



(Collingham, 1971b)

Dishers Creek Evaporation Basin



(EW&S, 1989c)

<Site Name> Hart Lagoon
<Synonyms>

Spatial

<**Location description**> 2 kilometres NW of Waikerie, SA, bounded by the River Murray to north and the Waikerie Irrigation Area to the south.

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Renmark

<**Location 1:100 000**> Morgan 6829

<**Zone**> 54H

<**Coordinates easting (AMG)**> 404500

<**Coordinates northing (AMG)**> 6218500

<**State**> South Australia

General

<**Year begun operation**> 1920's

<**Active/inactive**> Active

<**Full surface area (ha)**> 45 ha at 6.1 m AHD

<**Volume capacity (Ml)**>

<**Full surface level (m AHD)**> BM3 11.939 m AHD, Top pipe 6.997 m AHD, Top gauge 7.00 m AHD

<**Groundwater level (m AHD)**> 21-22 m AHD (Coffey, 1988)

<**Groundwater seepage/discharge**> Discharge

<**Average annual evaporation**> 2025 mm/yr (Coffey, 1988)

<**Volume disposed annually (Ml/yr)**> 50 ML/yr

<**Salinity of water disposed (EC)**> 815-2000 EC depending on irrigator; 1050-1340 mg/L

<**Range of salinity in basin (EC)**> 9290-15,700 EC (1987-88)

<**Sources of water to be disposed**> Irrigation drainage water from Waikerie Irrigation Area, Tile drains are in the Woorinen Formation, Monoman Formation, and Coonambidgal Formation; Overflow from sewage ponds (A. Telfer, pers. comm.)

<**Terminal/throughflow basin**> Terminal with part flushing ARI of floods 1:1.5

<**Range of elevation of lake surface with disposal**> 6.24-6.28 m AHD (1987-88)

<**Lining/treatment of base**> None

<**Review of environmental impacts**> Salinisation due to seepage from irrigation mound and raised groundwater levels due to construction of weir and Lock 2 (K. Smith, pers. comm.).

<Site Name> Hart Lagoon
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> SA Engineering and Water Supply

<**Project name**> Hart Lagoon

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**>

Geological

<**Site description and Geomorphology**> Hart Lagoon is a stranded meander of the Murray River. It has a typical complex of banks and channels with river red gums, reeds, river cooba, lignum, and river box (EWS, 1989a).

<**Subsurface investigations at site**>

<**Structural setting**> In Murray Trench west of the Morgan Fault and east of the Encounter Fault Zone (Firman, 1972).

<**Stratigraphic setting**> The basin is floored by the Coonambidgal Formation (2-3 m), and is underlain by the Monoman Formation (10-15 m), the Blanchetown Clay (0-3 m), the Upper Murray Group Limestone (10-15 m), Marl (Finnis Clay?) (0-4 m), the Lower Murray Group Limestone (110 m), the Renmark Group (200 m) (Coffey, 1988).

<**Host formation**> Coonambidgal Formation

<**Host lithofacies**> Grey river clay, sandy soils (E&WS piezometer WG4 at Ramco Recreation Ground)

<**Aquitard**> Coonambidgal Formation and Cadell Marl of Morgan Limestone? (Coffey, 1988), Finnis Clay

<**Aquitard lithofacies**> Coonambidgal Formation: Grey river clay, and sandy soil; Cadell Marl: Marls, marly limestone, and bryozoal (Coffey, 1988)

<**Aquifer**> Monoman Formation, Lower Murray Group Limestone and Upper Murray Group Limestone

<**Aquifer lithofacies**> Monoman Formation: Clean white sand, Murray Group Limestone: Calcarenite limestone (Coffey, 1988)

<**Comments**> Geology interpreted from Telfer and Watkins (1991) and Coffey (1988)

Summary of Hydrodynamics

<**Distance to Murray or tributary**> Up to 500 metres but it is also connected to the Murray River at the westerly downstream end

<**Head between basin and river/tributary**> Kept at or slightly below river level, evaporation actually causes inflows from the river

<**Direction of groundwater flow in regional aquifer**> Northeast towards the Murray River

<Site Name> Hart Lagoon
<Synonyms>

(Barnett, 1991)

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**> Cadell Marl: Kv = 2 x 10^{-4} m/d (Telfer and Watkins, 1991)

<**Thickness of aquitard**> Coonambidgal Formation: 2-3 metres; Cadell Marl: 10-15 metres; Finnis Clay: 10 metres

<**kv and kh of aquifer**> Monoman Formation: Kh = 2 to 25 m/d (Watkins, 1992d), Kh = 3 to 26 m/day from injection testing into WIB 2 and pumping from WAIK 9; Murray Group Limestone: Kv = 1.5 to 2.25 m/day, Kh = 0.15 to 1.08 m/day; Renmark Group: Kh = 1.8 m/day (Coffey, 1988); Upper Murray Group Limestone: Transmissivity = 250 m^2/d (Telfer and Watkins, 1991)

<**EC of aquifer**> Murray Group Limestone: 1385-29,600 EC depending on proximity to irrigation recharge, Monoman Formation: 36,000 EC (Coffey, 1988); Upper Murray Group Limestone: 10,000-20,000 mg/L (generally lower salinities prevail due to flushing from the irrigation areas), Lower Murray Group Limestone: 28,800 mg/L (less irrigation effects due to 'protection' by the Finnis Clay, the exception is at Waikerie Bend, where a long history of irrigation has lowered the salinities to less than 10,000 mg/L) (Telfer and Watkins, 1991).

<**Porosity of aquifer**>

<**Thickness of aquifer**> Monoman Formation: 10-15 m; Murray Group Limestone: 110 m

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**>Total groundwater accession due to irrigation is 24.4 ML/day, which is divided as follows: Tile drains to Ramco and Hart Lagoons = 1 ML/day, Cliff seepage = 0.2 ML/day, Growth in Norwest Bend Formation mound = 3 ML/day, Evaporation = 0.2 ML/day, and recharge into the Murray Group Limestone = 20 ML/day. This has formed a large groundwater mound in both the Norwest Bend Formation and the Murray Group Limestone resulting in a change of the pattern of flow within the aquifer. Flow has increased into the river with the relatively fresh (800-2200 EC) irrigation water displacing the high salinity water (19,000+ EC) into the Murray River. The Renmark Group also contributes saline water into the Murray Group (and thus the Murray River), because of its high hydraulic head (30 m AHD). The evaporation basin itself provides little recharge because it is kept below or at the level of the river (Coffey, 1988).

Salt balance equations from Ramco Lagoon (Hart thought to be similar), indicate that it receives 33 tonnes/d of salt. However through the tile drains it receives only 5 tonnes/d. The missing salt must be derived from the Lower Murray Group Limestone, or from moderate salinity water from the Monoman Formation pushed by the irrigation mound (Telfer and Watkins, 1991).

<**Hydraulic linkage to surface runoff**> The salinity in the Monoman Formation is higher between Hart Lagoon and the River Murray than it is away from the lagoon. This is because the lagoon intercepts the irrigation water and stops it from reaching the river. The high salinity (26,600 mg/L) in the Monoman Formation is the result of upward leakage from the Lower Murray Group Limestone. Where there is no lagoon, the irrigation water mixes and dilutes the high salinity water. Therefore, it must be assumed that Hart lagoon fulfils its purpose. However, a long term solution to the problem will require interception of the Lower Murray Group Limestone water and disposal to another site (Stockyard Plain?) (Telfer and Watkins, 1991).

<**Category - hydraulic stability**> Hart Lagoon causes few problems because it is kept at the level

of the river. However, there is large groundwater mound beneath the Waikerie Irrigation Area that is pushing high salinity water into the Murray River (Coffey, 1988).

<Category - degree of hydraulic isolation>

<Evaporation surplus> Evaporation = 1700 mm/yr, rainfall = 227 mm/yr, surplus = 1473 mm/yr (Coffey, 1988)

Interpretive 2

<Ranking of sustainability>

References Cited

Barnett, S.R. (South Australia Department of Mines and Energy), 1991- Renmark Hydrogeologic Map (1:250 000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia

Clarke, D.C., 1992- Waikerie Saline Groundwater Interception Scheme drilling and discharge testing general report., South Australia Department of Mines and Energy, Report Book 92/63.

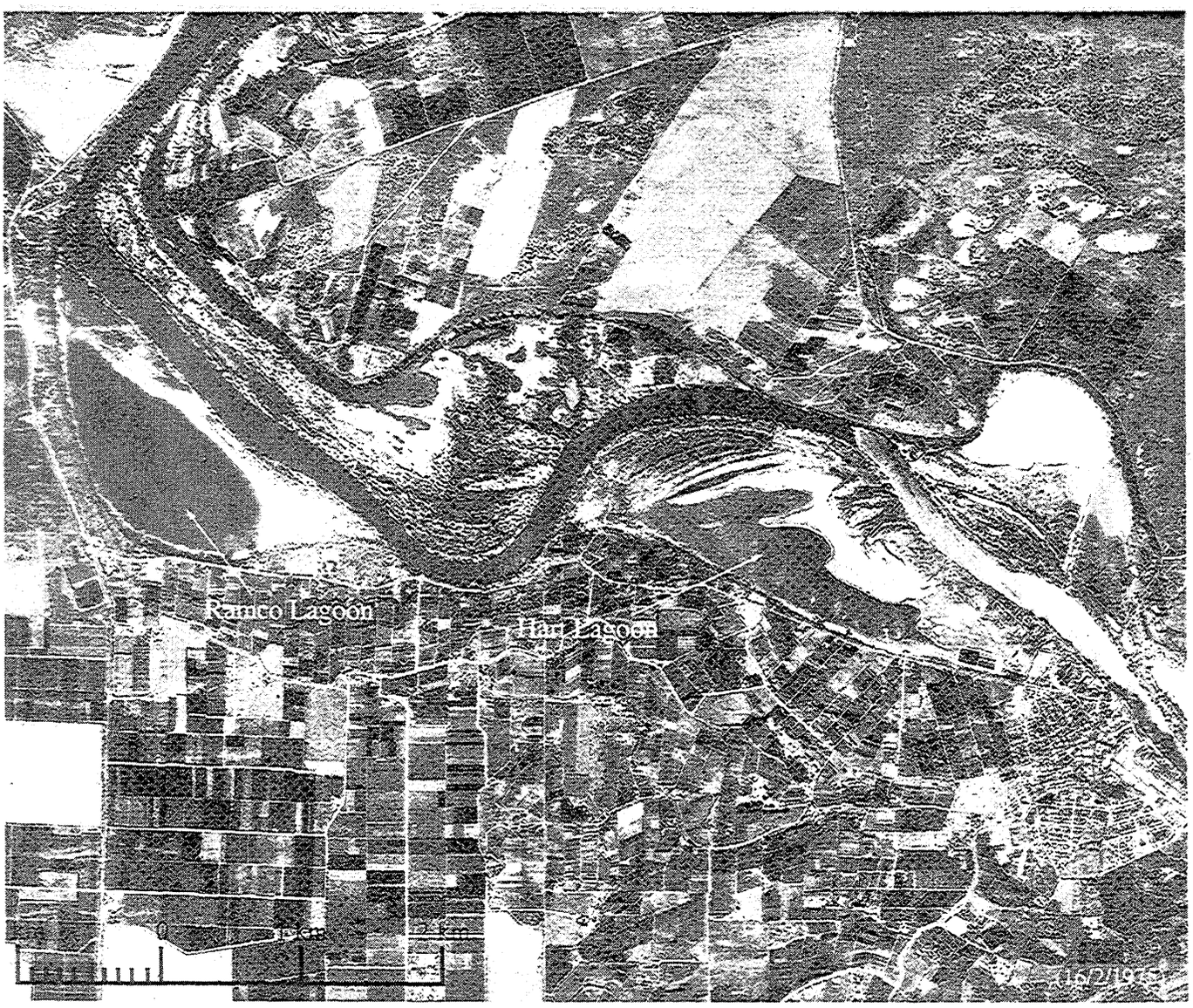
Coffey and Partners Pty Ltd, 1988- Waikerie Salinity Mitigation Study., South Australia Engineering and Water Supply,

Engineering and Water Supply (E&WS) (South Australia), 1989a- Enhancing wetlands., South Australian River Murray Wetlands Working Party Report, Engineering and Water Supply Department and Department of Environment and Planning, EWS 1439/88, Report no. 88/7, 174 p.

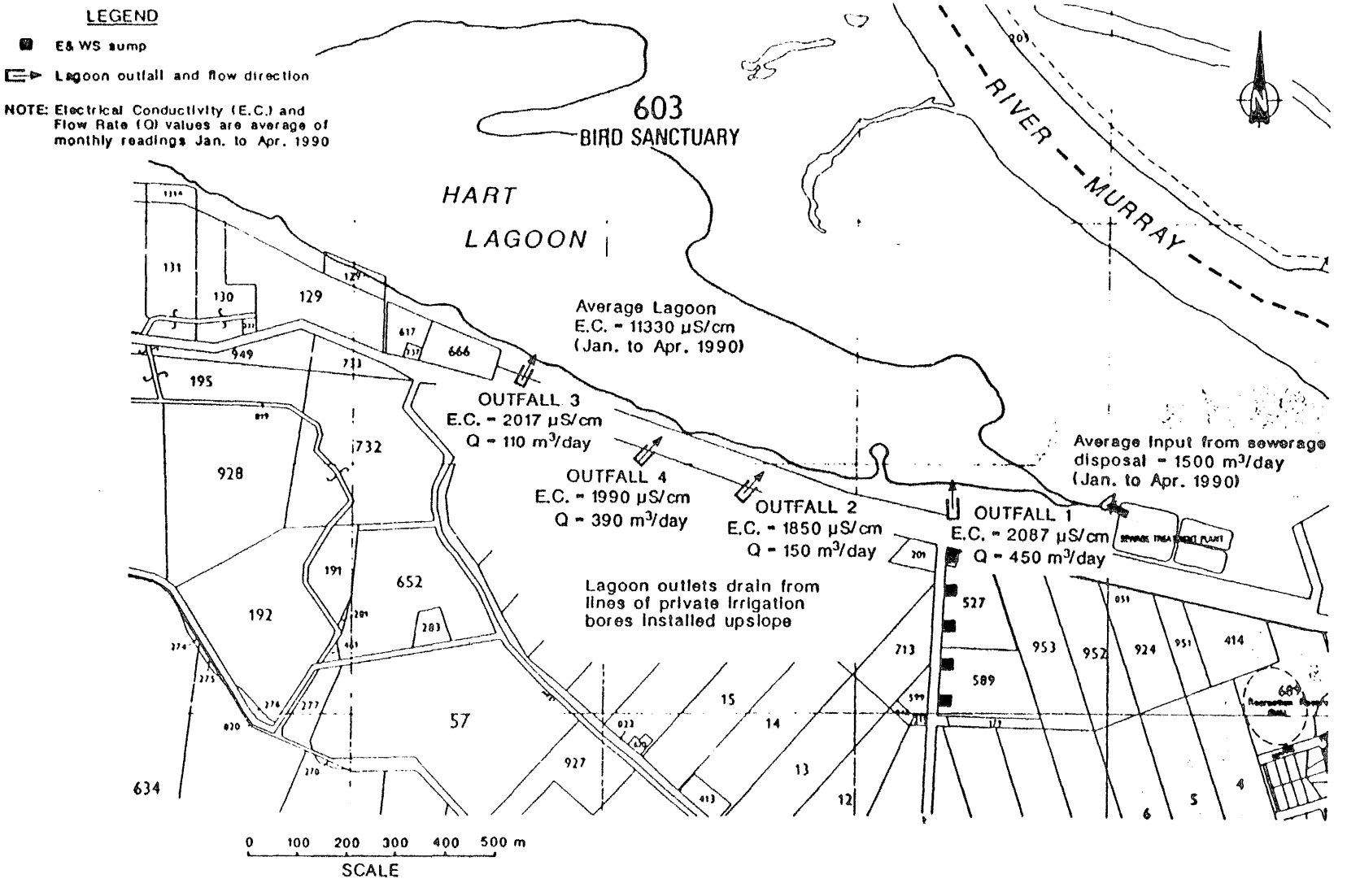
Firman, J.B., 1972- Renmark, South Australia - 1:250 000 Geological Series., Geological Survey of South Australia, Explanatory notes, SI/54-10.

Telfer, A., and Watkins, N., 1991- Waikerie Salt Interception Scheme final design report hydrogeology., South Australia Engineering and Water Supply, EWS 90/14, 51 p.

Watkins, N., 1992d- Loxton salinity and drainage investigation status report on hydrogeology., Murray Darling Basin Commission, EWS 92/20, 8 p.


Ramco Lagoon
Hari Lagoon
0
1km
2km

Hart Lagoon



(Telfer and Watkins, 1991)

<Site Name> Holder Lagoon
<Synonyms> Holder Disposal Basin

Spatial

<**Location description**> 1 kilometre west of Holder Settlement, SA, bordered on the north, west, and northeast by the River Murray and on the south and east by the Waikerie Irrigation Area.

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Renmark

<**Location 1:100 000**> Moorook 6929

<**Zone**> 54H

<**Coordinates easting (AMG)**> 409750

<**Coordinates northing (AMG)**> 6218500

<**State**> South Australia

General

<**Year begun operation**> 1920's

<**Active/inactive**> Active

<**Full surface area (ha)**> 1-2 ha

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> BM 6920/4023 12.290 m AHD, Top pipe 8.510 m AHD, Top gauge 8.700 m AHD

<**Groundwater level (m AHD)**> 8-10 m AHD (Barnett, 1991)

<**Groundwater seepage/discharge**> Seepage from irrigation mound

<**Average annual evaporation**> 1600-1700 mm/yr (K. Smith, pers. comm.)

<**Volume disposed annually (ML/yr)**> 5 ML/yr

<**Salinity of water disposed (EC)**> 5000-10,000 mg/L

<**Range of salinity in basin (EC)**>

<**Sources of water to be disposed**> Irrigation drainage water from small area of Holder Division Waikerie Irrigation Area.

<**Terminal/throughflow basin**> Terminal with partial flushing, ARI of flooding 1:10

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**>

<**Review of environmental impacts**> Little impact (K. Smith, pers. comm.)

<Site Name> Holder Lagoon
<Synonyms> Holder Disposal Basin

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> SA Engineering and Water Supply

<**Project name**> Holder Lagoon

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is located in a stranded meander on the floodplain of the River Murray.

<**Subsurface investigations at site**>

<**Structural setting**> The basin lies to the west of the Encounter Fault Zone and east of the Morgan Fault (Firman, 1972).

<**Stratigraphic setting**> The basin is floored by the Coonambidgal Formation (5 m), and underlain by the Monoman Formation (20 m), the Cadell Marl (10 m), the Murray Group Limestone (110 m), and the Renmark Group (200 m).

<**Host formation**> Coonambidgal Formation

<**Host lithofacies**> Organic clays and silts, silty sand

<**Aquitard**> Coonambidgal Formation and Cadell Marl

<**Aquitard lithofacies**> Coonambidgal Formation: Organic clays and silts, silty sand; Cadell Marl: Grey marl

<**Aquifer**> Monoman Formation

<**Aquifer lithofacies**> Medium to coarse quartz sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> On floodplain

<**Head between basin and river/tributary**>

<Site Name> Holder Lagoon
<Synonyms> Holder Disposal Basin

<Direction of groundwater flow in regional aquifer> North to Northwest towards the Murray River (Barnett, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Coonambidgal Formation: 5 metres; Cadell Marl: 10 metres

<kv and kh of aquifer> Monoman Formation: Kh = 10-20 m/d

<EC of aquifer> Monoman Formation: 14,000-35,000 mg/L (Barnett, 1991)

<Porosity of aquifer>

<Thickness of aquifer> Monoman Formation: 30 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin is located northeast of a large irrigation mound associated with the Waikerie Irrigation Area, but is somewhat shielded from the effects of the mound by the Murray River (Holder Bend). Nevertheless, the groundwater head in the area is elevated causing higher than normal flow to the river. The basin acts to intercept this water, concentrate it, and then release it during high flows. Salinities between the river and the basin are much higher (background salinity), than where no basin exists (watered down salinities, but at high volumes), indicating interception of the groundwater. The actual negative effect of Holder Lagoon on the salinity of the Murray River is small.

<Hydraulic linkage to surface runoff> The lagoon is flushed during high flows.

<Category - hydraulic stability>

<Site Name> Holder Lagoon
<Synonyms> Holder Disposal Basin

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Barnett, S.R. (South Australia Department of Mines and Energy), 1991- Renmark Hydrogeologic Map (1:250 000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia

Firman, J.B., 1972- Renmark, South Australia - 1:250 000 Geological Series., Geological Survey of South Australia, Explanatory notes, SI/54-10.


Holdet Lagoon
1 km
0
1 km
2 km
N
(16/2/1975)

<Site Name> K Country Basin
<Synonyms>

Spatial

<**Location description**> 7-9 kilometres WNW of Berri, SA and 3-4 kilometres NW of Glossop, SA beside an old quarry.

<**Located in Murray Trench**> No

<**Location 1:250 000**> Renmark

<**Location 1:100 000**> Renmark 7029

<**Zone**> 54H

<**Coordinates easting (AMG)**> 454600

<**Coordinates northing (AMG)**> 6210000

<**State**> South Australia

General

<**Year begun operation**> 1963

<**Active/inactive**> E&WS trying to close down

<**Full surface area (ha)**> 14 ha at 22.05 m AHD

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> 22.05 m AHD

<**Groundwater level (m AHD)**> 20-21 m AHD

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> 1600-1700 mm/yr (K. Smith, pers. comm.)

<**Volume disposed annually (ML/yr)**> 530 ML/yr

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**>

<**Sources of water to be disposed**> Irrigation drainage water

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**>

<**Review of environmental impacts**> Eventually the disposal water will be pumped to Berri Basin and then to Noora. Quarry near basin, extracts calcrete from the Woorinen Formation. The basin is responsible for raising the groundwater mound by up to 2 metres and there has been significant degradation of mallee vegetation in the immediate vicinity of the basin and nearby depressions. On the positive side, the basin has become a high value habitat for a wider range of bird species (K. Smith, pers. comm.)

<Site Name> K Country Basin
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> SA Engineering and Water Supply

<**Project name**> K Country Basin

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Small, low embankment

Geological

<**Site description and Geomorphology**> Located in a swale between two Woorinen sand ridges and surrounded by cleared and uncleared mallee.

<**Subsurface investigations at site**> 5 bores from around basin

<**Structural setting**> The basin is located east of the Renmark Trough and within the Paringa Embayment (Firman, 1972).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (1-2 m), which is underlain by the Parilla Sand (20-30 m), the Bookpurnong Beds (5 m), the Murray Group Limestone (110 m), and the Renmark Group (200 m).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**>Bookpurnong Beds

<**Aquitard lithofacies**> Dark grey silty clay

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 3.5 kilometres to Lake Bonney

<**Head between basin and river/tributary**> 12 metres

<**Direction of groundwater flow in regional aquifer**> Northwest into Lake Bonney (Barnett, 1991)

<Site Name> K Country Basin
<Synonyms>

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Bookpurnong Beds: 5-10 metres

<kv and kh of aquifer> Loxton-Parilla Sand: Kh = 2-6 m/day (Barnett, 1991)

<EC of aquifer> Loxton-Parilla Sand: 14,000-35,000 mg/L (Barnett, 1991)

<Porosity of aquifer>

<Thickness of aquifer> Loxton-Parilla Sand: 20-30 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Because of the irrigation mound associated with Berri Irrigation Area, groundwater flow within the Parilla Sand is directed to the northwest towards Lake Bonney (Barnett, 1991). Water leaks laterally through the Woorinen Formation and vertically into the Parilla Sand as fast as the water is pumped into it (K. Sith, pers. comm.).

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability> Basin is thought to be unstable because of high leakage rates (K. Smith, pers. comm.)

<Category - degree of hydraulic isolation> The basin leaks directly into the Parilla Sand and adds to the irrigation mound beneath Berri-Barmera which eventually discharging into Lake Bonney.

<Evaporation surplus>

Interpretive 2

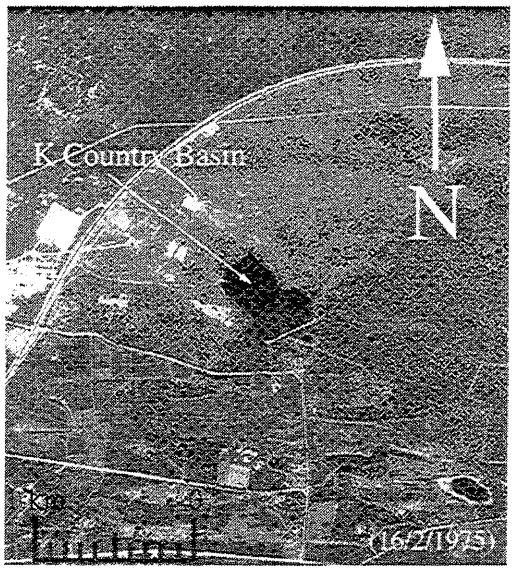
<Ranking of sustainability>

<Site Name> K Country Basin
<Synonyms>

References Cited

Barnett, S.R. (South Australia Department of Mines and Energy), 1991- Renmark Hydrogeologic Map (1:250 000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia

Firman, J.B., 1972- Renmark, South Australia - 1:250 000 Geological Series., Geological Survey of South Australia, Explanatory notes, SI/54-10.


K Country Basin
N
(16/2/1975)

<Site Name> Katarapko Island Evaporation Basin
<Synonyms> Katarapko Island Disposal Basin

Spatial

<**Location description**> 1 kilometre WNW of Loxton, SA, on north side of the River Murray

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Renmark

<**Location 1:100 000**> Renmark 7029

<**Zone**> 54H

<**Coordinates easting (AMG)**> 460000

<**Coordinates northing (AMG)**> 6189000

<**State**> South Australia

General

<**Year begun operation**> 1964

<**Active/inactive**> Active

<**Full surface area (ha)**> 812 ha (1988), 768 ha in 1984; 75 ha at 11 m AHD

<**Volume capacity (ML)**> 7600 ML

<**Full surface level (m AHD)**> 13.3 m AHD (1989 average), 12.5 m AHD (October 1984)

<**Groundwater level (m AHD)**> 12 m AHD

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> 1716 mm/yr

<**Volume disposed annually (ML/yr)**> 4000 ML/yr

<**Salinity of water disposed (EC)**> 3300-4200 EC

<**Range of salinity in basin (EC)**> 258 EC (8/1993) to 7840 (3/1988)

<**Sources of water to be disposed**> Comprehensive Drainage Scheme (CDS) water from Loxton Irrigation Area (industrial effluent disposal has ceased)

<**Terminal/throughflow basin**> Partial flushing capacity (on floodplain); ARI of floods 1:3

<**Range of elevation of lake surface with disposal**> 10.20-13.3 m AHD

<**Lining/treatment of base**> None

<**Review of environmental impacts**> Adjacent to Kapunda Island Conservation Park and within the Murray River National Park. There is salinisation of the area and some degradation of the vegetation. There have been numerous studies in the area, but it is unlikely that effective rehabilitation will occur until drainage discharge to the area ceases (K. Smith, pers. comm.).

<**Site Name**> Katarapko Island Evaporation Basin
<**Synonyms**> Katarapko Island Disposal Basin

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> SA Engineering and Water Supply

<**Project name**> Katarapko Island Evaporation Basin - Loxton Irrigation Area

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Levees and sandbanks on south, west, and east sides, adjoining the river bank, also 2 inlets, 1 outlet.

Geological

<**Site description and Geomorphology**> The basin is located on Katarapko Island and surrounded by the River Murray and Katarapko Creek. Within the basin is Yabbie Creek, North Horseshoe, South Horseshoe, North and South Lagoons, and 18 levee banks The diversity of wetlands is quite high and there is an ongoing attempt to revegetate the area (EWS, 1989a). The lagoons and disposal basin are ancient meanders (ox-bow lakes), left when the Murray River moved south.

<**Subsurface investigations at site**> Network of observation bores and piezometers.

<**Structural setting**> The basin is located within the Loxton Basin and the Paringa Embayment (Firman, 1972).

<**Stratigraphic setting**> The basin is floored by the Coonambidgal Formation (5 m), and is underlain by the Monoman Formation (5 m), the Bookpurnong Beds? (15 m), the Winnambool Formation (20 m), and the Murray Group Limestone (Collingham, 1989).

<**Host formation**> Coonambidgal Formation

<**Host lithofacies**> Black clays and silts, complex of levees, point bars, flood plains, surficial deposits, clay plugs, and crevasse splays (Caldwell Connell Engineers, 1981)

<**Aquitard**> Bookpurnong Beds and Winnambool Formation

<**Aquitard lithofacies**> Bookpurnong Beds: Fine sandy aquifers and clay aquitards; Winnambool Formation: marl (Collingham, 1989)

<**Aquifer**> Monoman Formation, Upper Calcarenite aquifer and Murray Group Limestone

<**Aquifer lithofacies**> Monoman Formation: Clean coarse to fine quartz sand; Upper Calcarenite Aquifer: calcarenite sand (Part of Winnambool Formation?); Murray Group Limestone: weakly cemented carbonate sand (Collingham, 1989)

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> <500 metres

<**Head between basin and river/tributary**> 1.5 m

<Site Name> Katarapko Island Evaporation Basin
<Synonyms> Katarapko Island Disposal Basin

<**Direction of groundwater flow in regional aquifer**> Northwest under low gradient (Monoman and/or Loxton), the Murray Group Limestone and Renmark Group flow to the west (Barnett, 1992).

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**> Bookpurnong Beds: Kv = 10^{-4} m/d to 10^{-5} m/d, Winnambool Formation: Kv = 10^{-5} m/d to 10^{-6} m/d (Watkins, 1992d); Bookpurnong Beds: Kv = 3.72 x 10^{-5} to 1.81 x 10^{-6} m/d, Winnambool Formation: Kv = 1.07 x 10^{-4} m/d (Watkins, 1991)

<**Thickness of aquitard**> Bookpurnong: 5-10 metres, Winnambool Formation: 10-15 metres; Salinity of aquitard Bookpurnong Beds: 28,300 mg/L, Winnambool Formation: 26,200 mg/L (Watkins, 1992d)

<**kv and kh of aquifer**> Morgan Limestone (Murray Group): Kv = 0.1 to 0.2 m/d, Kh = 1-2 m/d; Monoman Formation: Kh = 2-25 m/d depending on soil type (Watkins, 1992d) Upper Calcarenite Aquifer: Kv = 0.013 m/d (Watkins, 1991)

<**EC of aquifer**> Murray Group Limestone: 17,900 mg/L; Monoman Formation: 12,700-35,000 mg/L increasing with distance from the river; Upper Calcarenite Aquifer: 26,200 mg/L (Watkins, 1992d)

<**Porosity of aquifer**>

<**Thickness of aquifer**> Monoman Sands: 5-8 metres, Upper Calcarenite Aquifer: 5-10 metres, Murray Group Limestone: 70 metres (Watkins, 1992d)

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> Watkins (1992d), estimated that 0.04 ML/ha/day percolated through the Bookpurnong Beds and into the Upper Calcarenite Aquifer from the irrigation mound of the Loxton Irrigation Area. Input from the basin should be relatively low because of the low head (1.5 m) of the evaporation basin compared to the irrigation mound (12 metres). Total accession into the Upper Calcarenite due to the basin should be about 0.005 ML/ha/day.

Overall, the potentiometric head from the Remark Group (21 metres) and the Murray Group Limestone (2 metres) is upwards, so any leakage would be into the evaporation basin (Barnett, 1992).

<**Hydraulic linkage to surface runoff**> Because the pool level is kept at 11.5 m AHD (1.5 metres above Murray River) there is steep gradient causing displacement of saline water into the river at 50.8 t/d with a groundwater flux of 1.95 ML/day (Watkins, 1992d).

<**Category - hydraulic stability**> Katarapko Island Evaporation Basin adds over 50 tons of salt per day into Murray River. The large irrigation mound associated with the Loxton irrigation Area, combined with the general rise in regional groundwater of 1 cm/yr due to clearing, suggests that the region will continue to increase its salt load into the Murray River in the foreseeable future (Watkins, 1992d).

<**Category - degree of hydraulic isolation**>

<Evaporation surplus> 1438 mm/yr (Evaporation = 1716 mm/yr and precipitation = 278 mm/yr) (Caldwell Connell Engineers, 1981)

Interpretive 2

<Ranking of sustainability>

References Cited

Barnett, S.R., 1992- Regional hydrogeology of the Loxton-Noora area, Murray basin, South Australia., South Australia Department of Mines and Energy, Geological Survey, Report Book 92/15, 6 p.

Caldwell Connell Engineers Pty Ltd, 1981- Katarapko Island evaporation basin environmental study., South Australia Engineering and Water Supply Department 1981-04, 70 p.

Cole, P.J., van der Sommen, F., and Smith K.G., 1974- Environment Impact Study Katarapko Island Evaporation Basin., Soil Conservation Branch, South Australia Department of Agriculture, S8/74.

Collingham, E.B., 1989- Katarapko Island Evaporation Basin - Loxton Irrigation Area: Summary of hydrogeology., South Australia Engineering and Water Supply, unpublished.

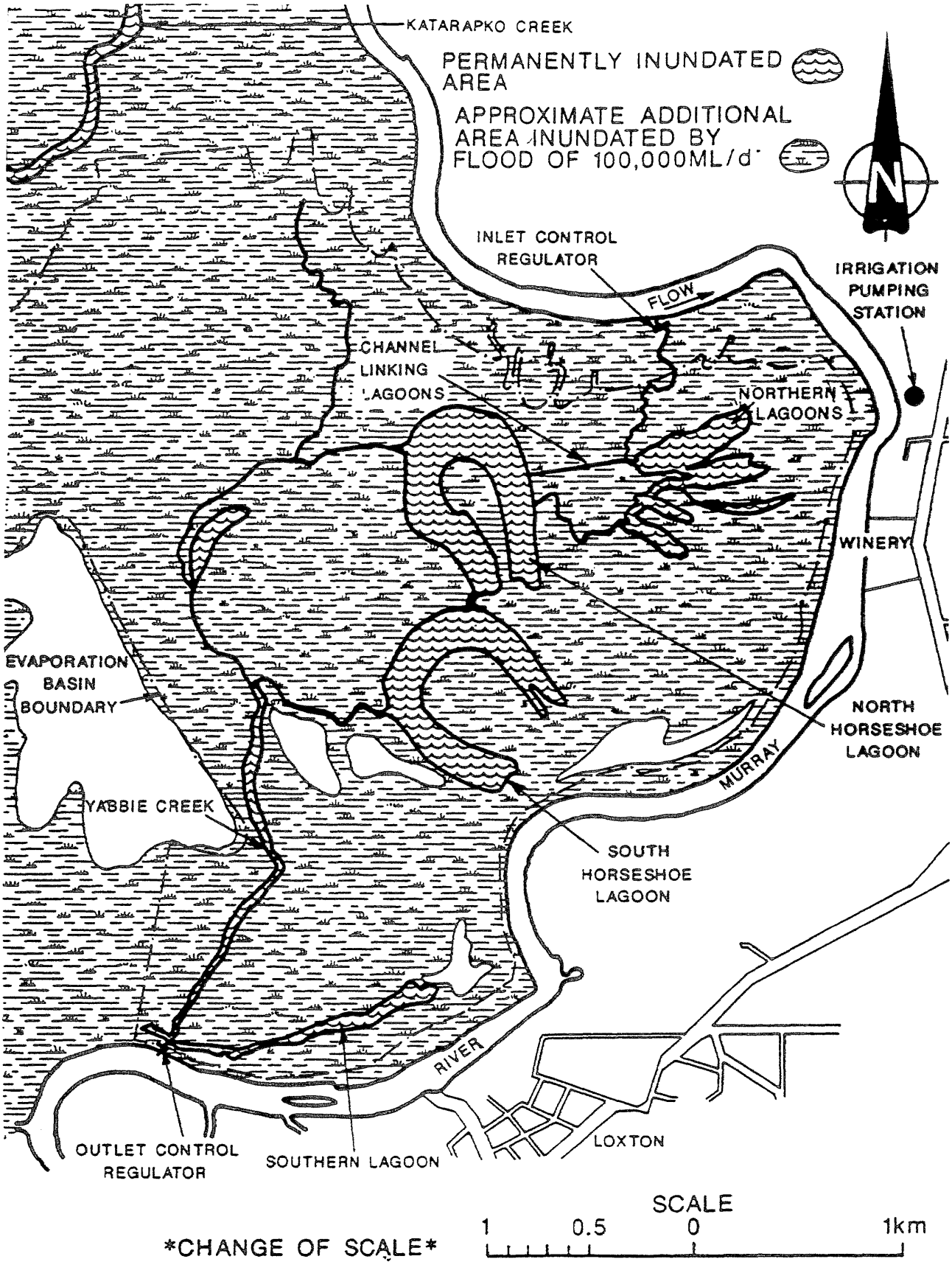
Engineering and Water Supply (E&WS) (South Australia), 1989a- Enhancing wetlands., South Australian River Murray Wetlands Working Party Report, Engineering and Water Supply Department and Department of Environment and Planning, EWS 1439/88, Report no. 88/7, 174 p.

Watkins, N., 1992d- Loxton salinity and drainage investigation status report on hydrogeology., Murray Darling Basin Commission, EWS 92/20, 8 p.

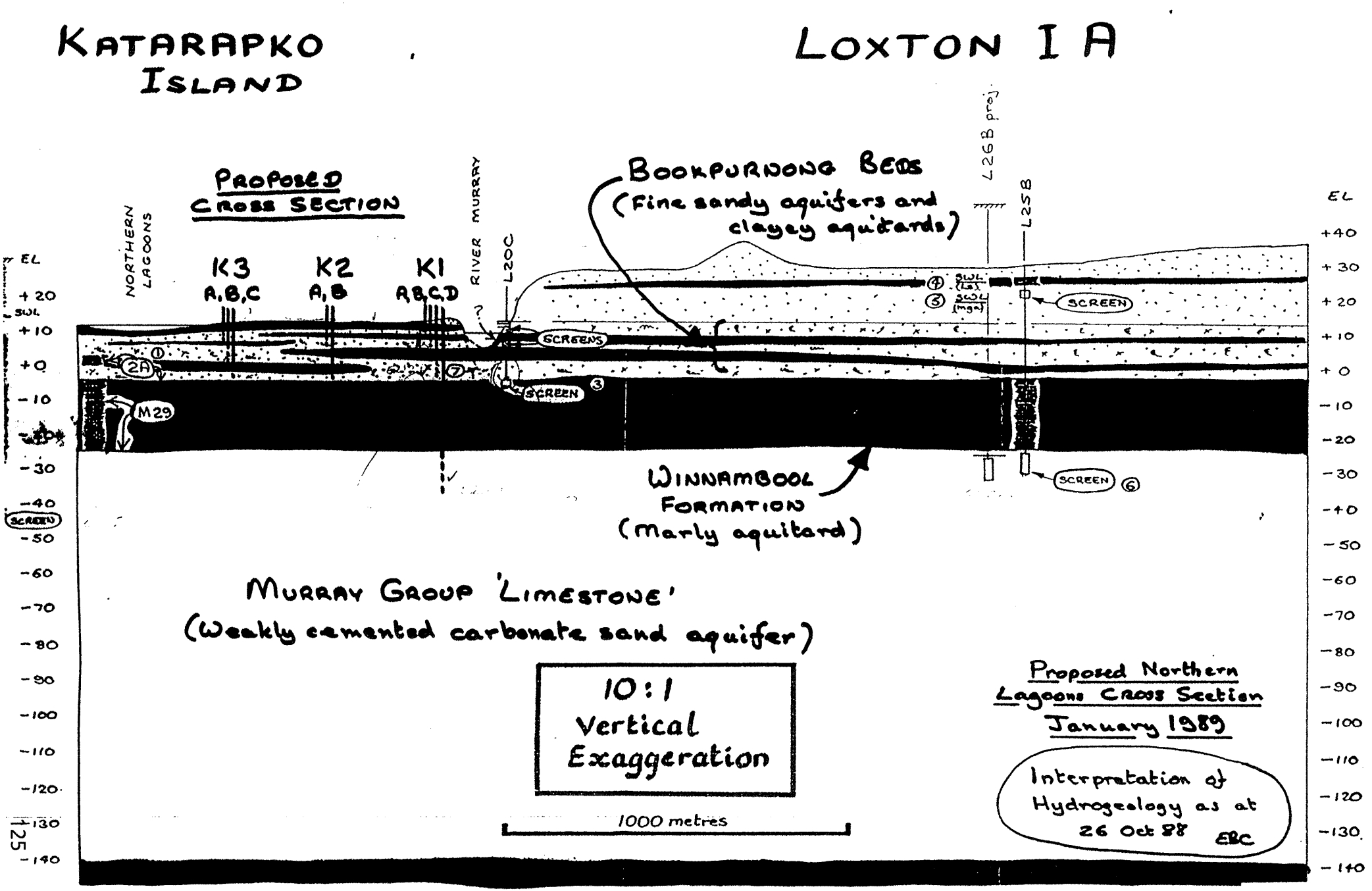
Watkins, N., 1991- Loxton Salinity Mitigation Studies Noora Drainage Disposal Basin regional impact studies: results of a drilling and pump testing programme March-August 1991., South Australia Engineering and Water Supply Department., EWS 91/24, 5 p


N
Kasatapko Island Basin
1 Km
0
1 Km
2 Km

Katarapko Island Evaporation Basin



(EW&S, 1989a)



(Jacobs and Collingham, 1984)

<Site Name> Lake Bonney
<Synonyms>

Spatial

<**Location description**> Due NNW of Barmera, SA and the Sturt Highway

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Renmark

<**Location 1:100 000**> Moorook 6929

<**Zone**> 54H

<**Coordinates easting (AMG)**> 449000

<**Coordinates northing (AMG)**> 6213000

<**State**> South Australia

General

<**Year begun operation**> 1930 ceased diversion of irrigation water; and in 1972, ceased discharge of drainage water

<**Active/inactive**> Inactive

<**Full surface area (ha)**> 1650 ha

<**Volume capacity (ML)**> 61,000 ML

<**Full surface level (m AHD)**> 9.80 m AHD

<**Groundwater level (m AHD)**> 10 m AHD (Barnett, 1991)

<**Groundwater seepage/discharge**> Discharge due to groundwater inflow from irrigation mound

<**Average annual evaporation**> Regional: 2250 mm/yr (Barnett, 1991); local: 1600-1700 mm/yr (K. Smith, pers. comm.)

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**> Currently no disposal

<**Range of salinity in basin (EC)**> 5000-6000 EC due to evaporation; 1930 = 1200 EC; 1938 = 5000 EC; 1940's = 7000 EC; 1963 = 7000 EC; 1981 = 7000 EC; Present = 4900-6600 EC (Smith, 1990)

<**Sources of water to be disposed**> Currently no disposal

<**Terminal/throughflow basin**> Aim at stability by holding the water level of Lock 3 stable

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**>

<**Review of environmental impacts**>

<Site Name> Lake Bonney
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> SA Engineering and Water Supply

<**Project name**> Lake Bonney

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> Large NNW-SSE trending lake 7 kilometres long and 3 kilometres wide with a large highly dissected lunette? on the eastern margin, and connected to the River Murray by Chambers Creek. Possibly a stranded meander of the Murray River (Coonambidgal Formation) along the eastern margin that was later the site for lunette accretion.

<**Subsurface investigations at site**> 5 SADME bores

<**Structural setting**> The basin is located east of the Hamley Fault and within the Renmark Trough (Firman, 1972).

<**Stratigraphic setting**> The basin is floored by the Coonambidgal Formation and/or the Woorinen Formation (5 m), and is underlain by the Blanchetown Clay (5-10 m), the Parilla Sand (30-50 m), the Murray Group Limestone (110 m), and the Renmark Group (250 m).

<**Host formation**> Coonambidgal Formation and/or Woorinen Formation

<**Host lithofacies**> Coonambidgal Formation: Organic silts, clays, and silty sand; Woorinen Formation: Red silt and sand

<**Aquitard**> Blanchetown Clay

<**Aquitard lithofacies**> Clay, silty clay, and sandy clay

<**Aquifer**> Parilla Sand (regional aquifer)

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 2 kilometres

<**Head between basin and river/tributary**>

<Site Name> Lake Bonney
<Synonyms>

<**Direction of groundwater flow in regional aquifer**> There is groundwater flow into Lake Bonney due to the irrigation mound beneath Renmark Irrigation Area (Barnett, 1991).

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**>

<**Thickness of aquitard**> Blanchetown Clay: 5-10 metres

<**kv and kh of aquifer**> Parilla Sand: Kh = 2-6 m/d (Barnett, 1991)

<**EC of aquifer**> Parilla Sand: 7000 EC (flushed by Cobdogla irrigation Area)

<**Porosity of aquifer**>

<**Thickness of aquifer**> Parilla Sand: 30-50 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> There is a large mound (12 m) associated with the Cobdogla Irrigation Area that forces groundwater to the northwest and into Lake Bonney. Flow is either within the Woorinen Formation on top of the Blanchetown Clay (perched aquifer), or within the Parilla Sand (regional aquifer). Consequently, the salinity of Lake Bonney is controlled by both the salinity of the irrigation water and evaporation within the basin and not by the salinity of the regional aquifer.

<**Hydraulic linkage to surface runoff**> Connection to Chambers Creek is direct through outlet on the northwest corner of Lake Bonney.

<**Category - hydraulic stability**>

<**Category - degree of hydraulic isolation**>

<Site Name> Lake Bonney
<Synonyms>

<Evaporation surplus> 1450 mm (evaporation = 1700 mm/yr, precipitation = 250 mm/yr)

Interpretive 2

<Ranking of sustainability>

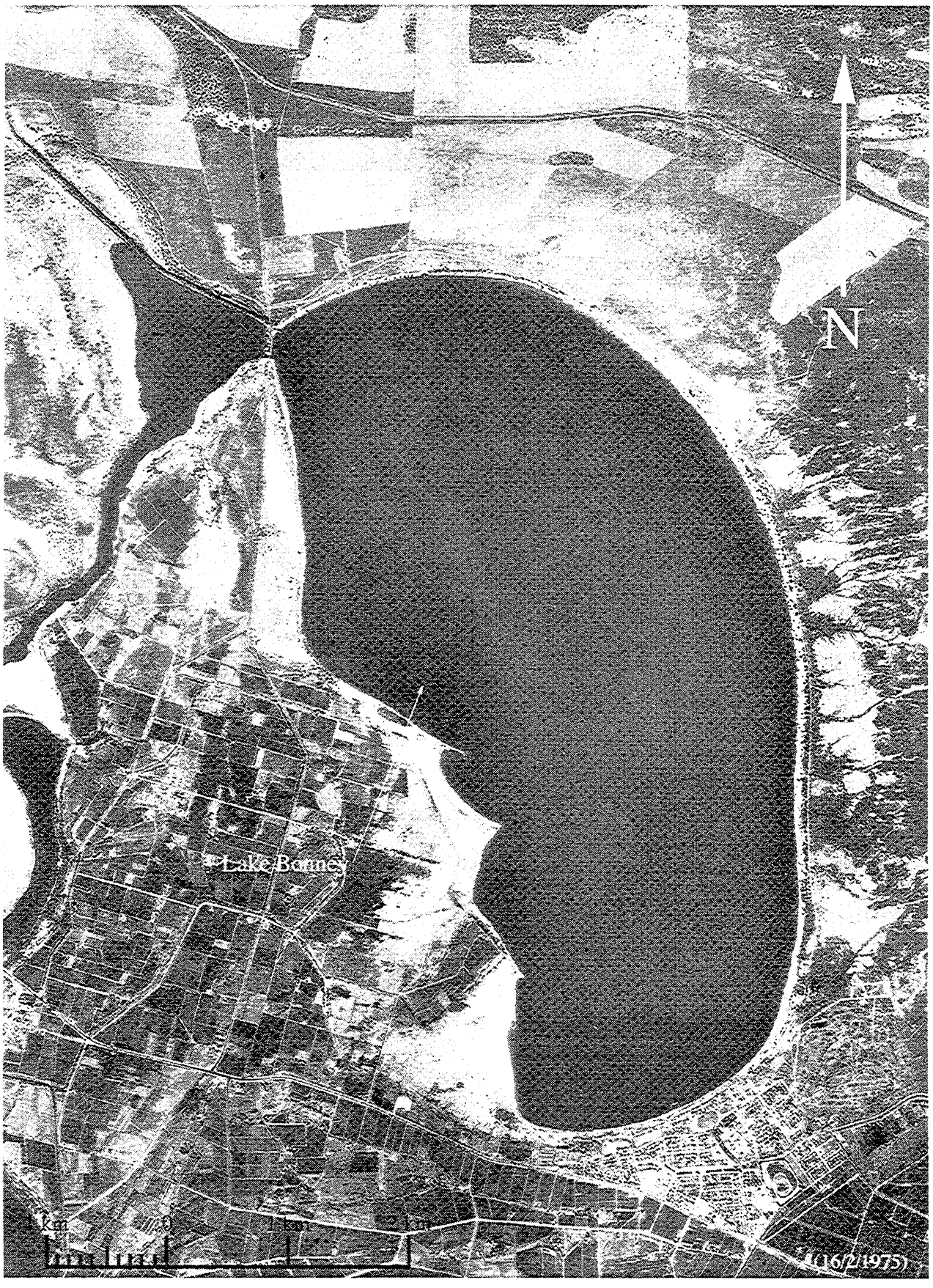
References Cited

Barnett, S.R. (South Australia Department of Mines and Energy), 1991- Renmark Hydrogeologic Map (1:250 000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia

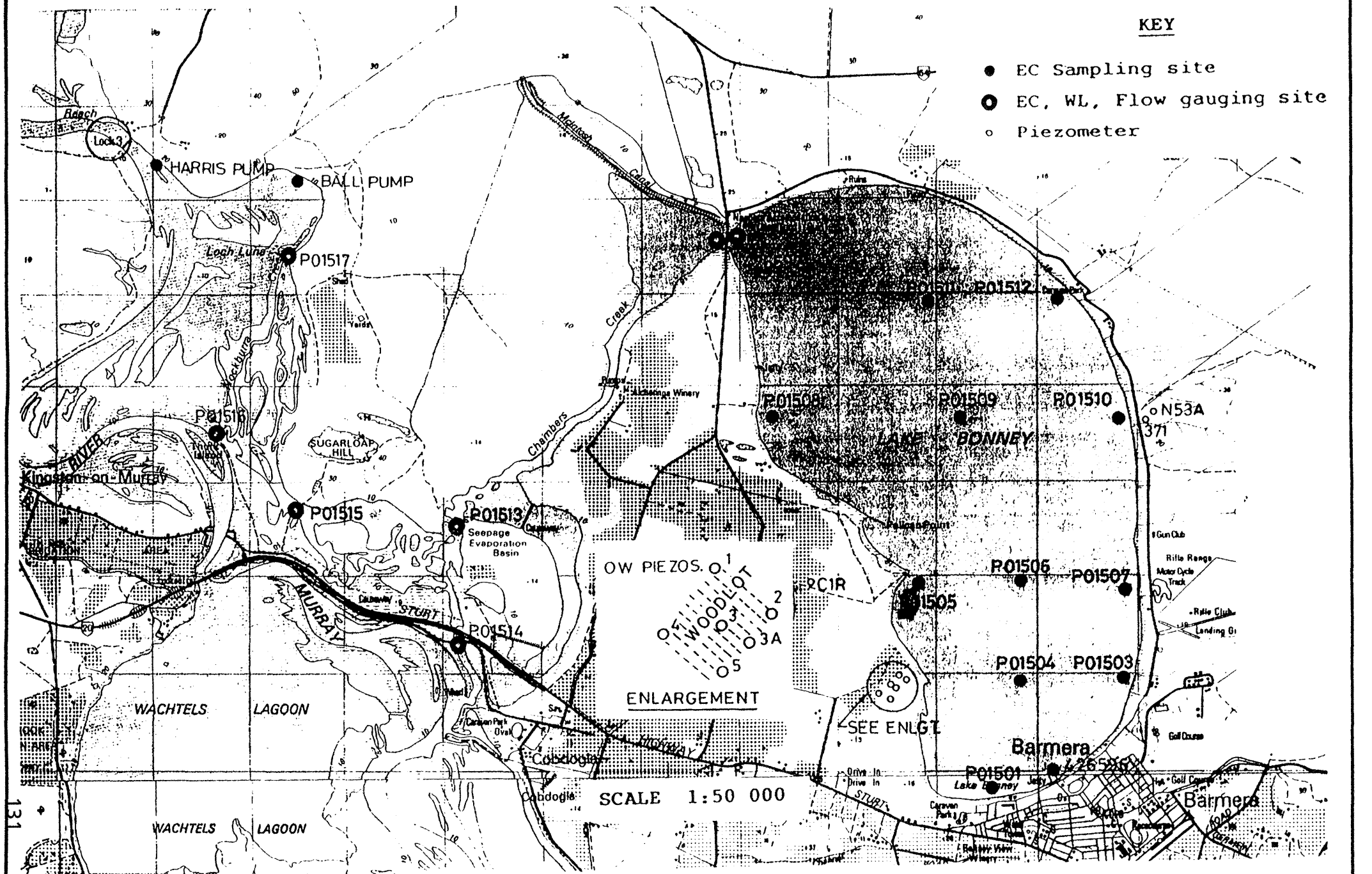
Firman, J.B., 1972- Renmark, South Australia - 1:250 000 Geological Series., Geological Survey of South Australia, Explanatory notes, SI/54-10.

Smith, K.G., 1990- Summary report on the trial lowering and refilling of Lake Bonney (Riverland), May-June 1990., South Australia Engineering and Water Supply Department, BR73

Stace, P., 1990- Lake Bonney lowering and refilling trial May 1989 to June 1990., Technical report. Hydrological activities., South Australia Engineering and Water Supply, BR72


N
Lake Bonney
1 Km
0
1 Km
2 Km
(16/2/1975)

Lake Bonney



(Smith, 1990)

<Site Name> Lake Merreti and Clover Lake
<Synonyms>

Spatial

<**Location description**> 10.2 kilometres NE of Cooltong, 1.2 kilometres east of Old Wentworth Road

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Renmark

<**Location 1:100 000**> Renmark 7029

<**Zone**> 54H

<**Coordinates easting (AMG)**> 477500

<**Coordinates northing (AMG)**> 6236000

<**State**> South Australia

General

<**Year begun operation**> From 1983 onwards, used to keep water level high (and salinities low) during low river flows by release of lake water into Ral Ral Creek to help Chaffey irrigation Area for a short period following the recession of high river flows.

<**Active/inactive**> Active

<**Full surface area (ha)**> 370 ha

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> 16.30 m AHD; (Clover Lake is 0.7 m above pool level and is usually dry)

<**Groundwater level (m AHD)**> 16-18 m AHD (Barnett, 1991)

<**Groundwater seepage/discharge**> Discharge

<**Average annual evaporation**> Regional: 2250 mm/yr (Kernich, 1984)); Local: 1600-1700 mm/yr

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**> No disposal

<**Range of salinity in basin (EC)**> 365-1810 EC

<**Sources of water to be disposed**> No disposal, only storage

<**Terminal/throughflow basin**> Throughflow flushing facility

<**Range of elevation of lake surface with disposal**> 16.23-19.00 m AHD

<**Lining/treatment of base**> None

<Review of environmental impacts>

<Site Name> Lake Merreti and Clover Lake
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> SA Engineering and Water Supply and South Australia Department of Environment and Natural Resources

<**Project name**> Lake Merreti and Clover Lake

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> 2 inlets, 1 outlet

Geological

<**Site description and Geomorphology**> On upper terrace deposit of the Murray River bounded to the south by the clays of the Coonambidgal Formation and to the east and north by lunettes (Yamba Formation) (Rogers, 1978).

<**Subsurface investigations at site**>

<**Structural setting**>The basin is located east of the Chowilla Fault and the Renmark Trough (Rogers, 1978).

<**Stratigraphic setting**> The basin is floored by the Rufus Formation (5 m) (Qc_1 of Rogers, 1978) and bounded on the east and north with the Yamba Formation. The surficial deposits are underlain by the Monoman Formation (20-25 m), the Parilla Sand (30 m), the Bookpurnong Beds/Winnambool Formation (20 m), the Murray Group Limestone (110 m), and the Renmark Beds (250 m) (Collingham, 1990).

<**Host formation**> Rufus Formation

<**Host lithofacies**> Red brown clayey sand, and grey clay and sand

<**Aquitard**> Bookpurnong Beds/Winnambool Formation and a low permeability zone in the Lower Loxton (Parilla) Sand (Collingham, 1990)

<**Aquitard lithofacies**> Bookpurnong Beds/Winnambool Formation: Dark grey silt clay and marl

<**Aquifer**> Monoman Sand and Parilla Sand

<**Aquifer lithofacies**> Fine to medium quartz sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 1.6 kilometres to Ral Ral Creek and 3.5 kilometres to Murray River

<Site Name> Lake Merreti and Clover Lake
<Synonyms>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer>

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Bookpurnong Beds/Winnambool Formation: 20 metres

<kv and kh of aquifer> Monoman Formation: Kh = 10 m/d; Parilla Sand: Kh = 5 m/d (Collingham, 1990)

<EC of aquifer> Parilla Sand: 35,000-100,000 mg/L (Barnett, 1991)

<Porosity of aquifer>

<Thickness of aquifer> Monoman Formation: 20-25 metres; Parilla Sand: 30 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Lake Merreti formed due to deflation of the Rufus Formation and subsequent discharge into the basin during periods of higher watertables. Presently, the basin receives discharge from the Monoman Formation (which is contact with the Parilla Sand) which is driven by river water and the irrigation mound beneath the Renmark Irrigation Area. Because of the upward gradient in the aquifer there should be no leakage into the Monoman Formation or degradation of the floodplain due to presence of the lake. However, Clover Lake is at a high level (possibly above the watertable) and could possibly recharge into the Monoman, but because it is rarely used, and because it has a low salinity the effects should be slight.

<Hydraulic linkage to surface runoff> Water is kept within Lake Merreti for release during low river flows, immediately following high river flows, so that irrigators from Chaffey Irrigation Area may have good quality water. For the remainder of the time, water flows into the lake from Ral Ral Creek in order to make up for evaporation loses (K. Smith, pers. comm.).

<Category - hydraulic stability>

<Site Name> Lake Merreti and Clover Lake
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Collingham, E.B., 1990- Chowilla hydrogeological studies by the Engineering and Water Supply Department South Australia: Technical discussion papers. Civil Section Engineering Services Group Engineering and Water Supply Department, South Australia, EWS unregistered.

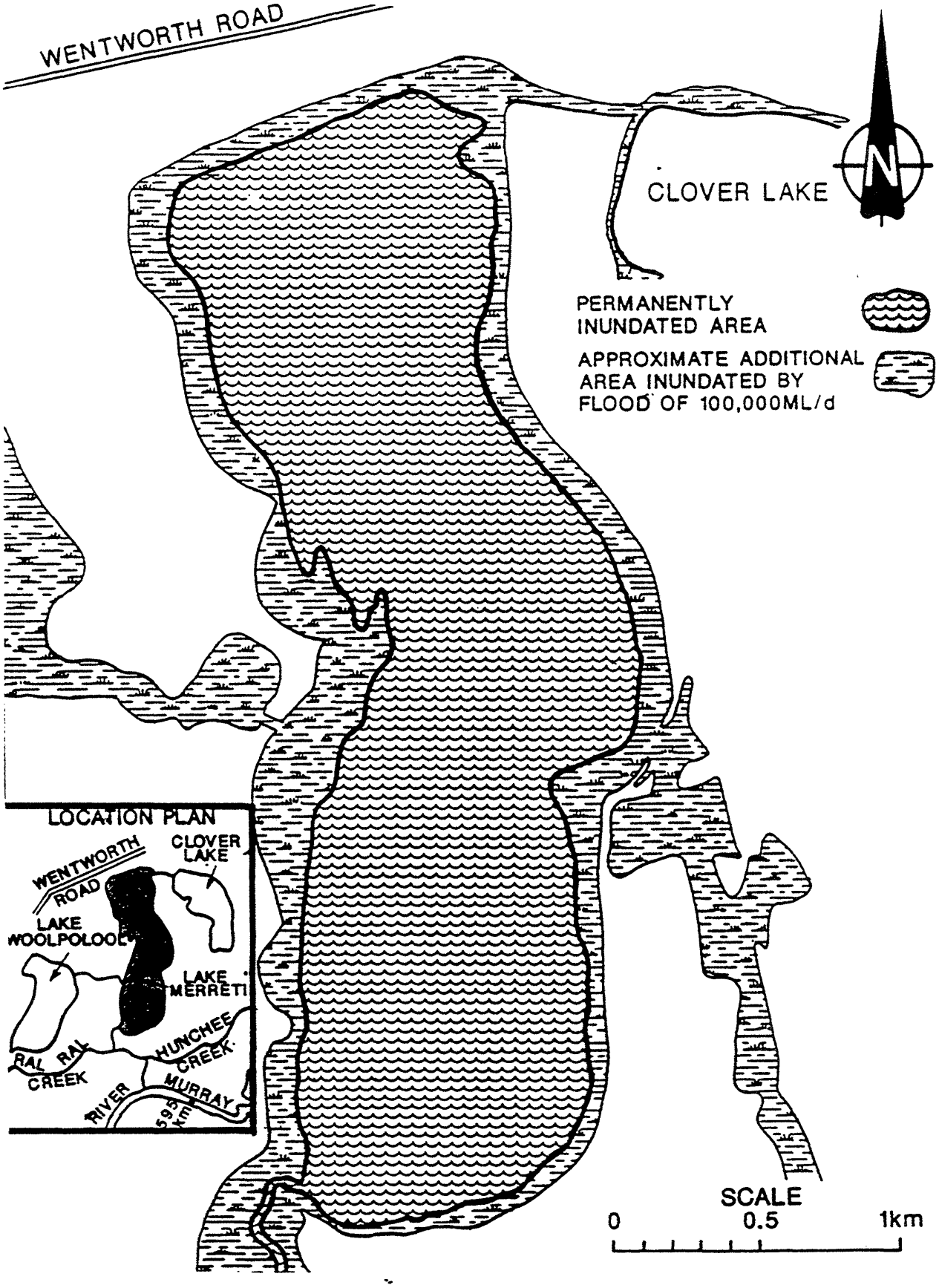
Engineering and Water Supply (E&WS) (South Australia), 1989a- Enhancing wetlands., South Australian River Murray Wetlands Working Party Report, Engineering and Water Supply Department and Department of Environment and Planning, EWS 1439/88, Report no. 88/7, 174 p.

Kernich, A.M., 1984- The climate of the River Murray and environs, South Australia., Technical report, South Australia Department of Agriculture.

Rogers, P.A., 1978- Chowilla, South Australia - 1:250 000 Geological Series., Geological Survey of South Australia, Explanatory notes, SI/54-6.

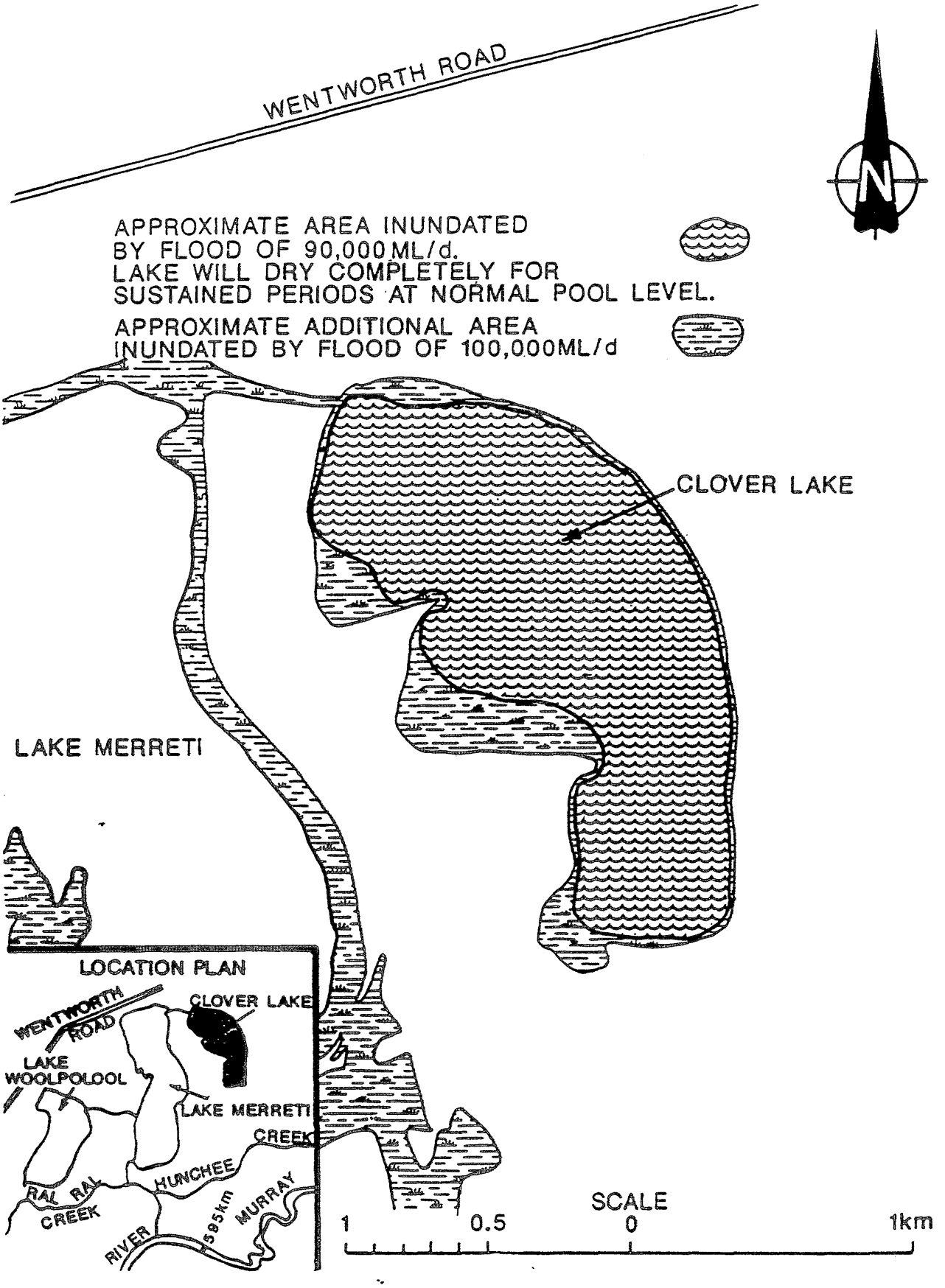
N
Lake Woolpolool
Lake Merreti
1 km
0
1 km
2 km

Lake Merreti



(EW&S, 1989a)

Clover Lake



(EW&S, 1989a)

<Site Name> Lake Woolpolool
<Synonyms>

Spatial

<**Location description**> Adjacent to and NE of Calpernum, SA, 15.5 kilometres N of Renmark, SA

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Renmark

<**Location 1:100 000**> Renmark 7029

<**Zone**> 54H

<**Coordinates easting (AMG)**> 474500

<**Coordinates northing (AMG)**> 6234500

<**State**> South Australia

General

<**Year begun operation**> From the 1940's to 1956: During dry periods, the lake bed was cropped; Present: The lake remains isolated and dry except during high river flows when water is diverted to the lake from Ral Ral Creek

<**Active/inactive**> Active

<**Full surface area (ha)**> 330 ha

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> 15.9 m AHD

<**Groundwater level (m AHD)**> 16.45 m AHD

<**Groundwater seepage/discharge**> Discharge

<**Average annual evaporation**> Regional: 2250 mm/yr (Kernich, 1984); Local: 1600-1700 mm/yr

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**> 365-1810 EC

<**Range of salinity in basin (EC)**>

<**Sources of water to be disposed**> Diversion of water from Ral Ral Creek

<**Terminal/throughflow basin**> Terminal; cutoff from Ral Ral Creek by regulator except during +200,000 ML flood (1 in 50 years), otherwise flushing would adversely affect Ral Ral Creek.

<**Range of elevation of lake surface with disposal**> 0.39 m?

<**Lining/treatment of base**> None

<**Review of environmental impacts**> Known as a significant contributor of salinity into Ral Ral Creek (EWS, 1989a). Lake Woolpolool is normally dry and has a high salinity due to evaporation. A large flood event is required to flush out salt and to improve wetland habitat.

<Site Name> Lake Woolpolool
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> South Australia Engineering and Water Supply and South Australia Department of Environment and Natural Resources

<**Project name**> Lake Woolpolool

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> 1 inlet/outlet

Geological

<**Site description and Geomorphology**> The basin is located on the upper terrace deposit of the Murray River (Rufus Terrace) and is bounded to the south by the clays of the Coonambidgal Formation and to the east and north by lunettes (Yamba Formation) (Rogers, 1978).

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located east of the Chowilla Fault and the Renmark Trough (Rogers, 1978).

<**Stratigraphic setting**> The basin is floored by the Rufus Formation (5 m) (Qc_1 of Rogers, 1978) and bounded on the east and north with the Yamba Formation, the surficial deposits are underlain by the Monoman Formation (20-25 m), the Parilla Sand (30 m), the Bookpurnong Beds/Winnambool Formation (20 m), the Murray Group Limestone (110 m), and the Renmark Beds (250 m) (Collingham, 1990).

<**Host formation**> Rufus Formation

<**Host lithofacies**> Red brown clayey sand, and grey clay and sand

<**Aquitard**> Rufus Formation, Bookpurnong Beds/Winnambool Formation and a low permeability zone in the Lower Loxton (Parilla) Sand (Collingham, 1990)

<**Aquitard lithofacies**> Rufus Formation: Red brown clayey sand and grey clay and sand; Bookpurnong Beds: Dark grey silt clay

<**Aquifer**> Monoman Sand and Parilla Sand

<**Aquifer lithofacies**> Fine to medium quartz sand

<**Comments**>

<Site Name> Lake Woolpolool
<Synonyms>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 0.5 kilometres to Ral Ral Creek

<**Head between basin and river/tributary**>

<**Direction of groundwater flow in regional aquifer**> Into Lake Woolpolool form the east and west (Barnett, 1991)

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**> Lower Loxton Sand (Parilla): Kv = 0.1 metres/d

<**Thickness of aquitard**> Rufus Formation: 5 metres; Bookpurnong Beds/Winnambool Formation: 20 metres; Lower Loxton Sand: 10 metres

<**kv and kh of aquifer**> Monoman Formation: Kh = 10 metres/d; Parilla Sand: Kh = 5 metres/d (Collingham, 1990)

<**EC of aquifer**> Parilla Sand: 35,000-100,000 mg/L (Barnett, 1991)

<**Porosity of aquifer**>

<**Thickness of aquifer**> Monoman Formation: 20-25 metres; Parilla Sand: 30 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> Lake Woolpolool formed due to deflation of the Rufus Formation and subsequent discharge into the basin during periods of higher watertables. Presently, the basin receives discharge from the Monoman Formation (which is contact with the Parilla Sand), which is in turn driven by river water and the irrigation mound beneath the Renmark Irrigation Area. When water levels are low there should be no leakage into the Monoman Formation or degradation of the floodplain due to presence of the lake, because of the upwards gradient within the Monoman Formation. However, when the lake is full the gradient reverses and the lake seeps into the aquifer and causes discharge from the Monoman Formation into Ral Ral Creek.

<**Hydraulic linkage to surface runoff**> Flooded by the River Murray during 1 in 50 year flood (200,000 ML)

<Site Name> Lake Woolpoolool
<Synonyms>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

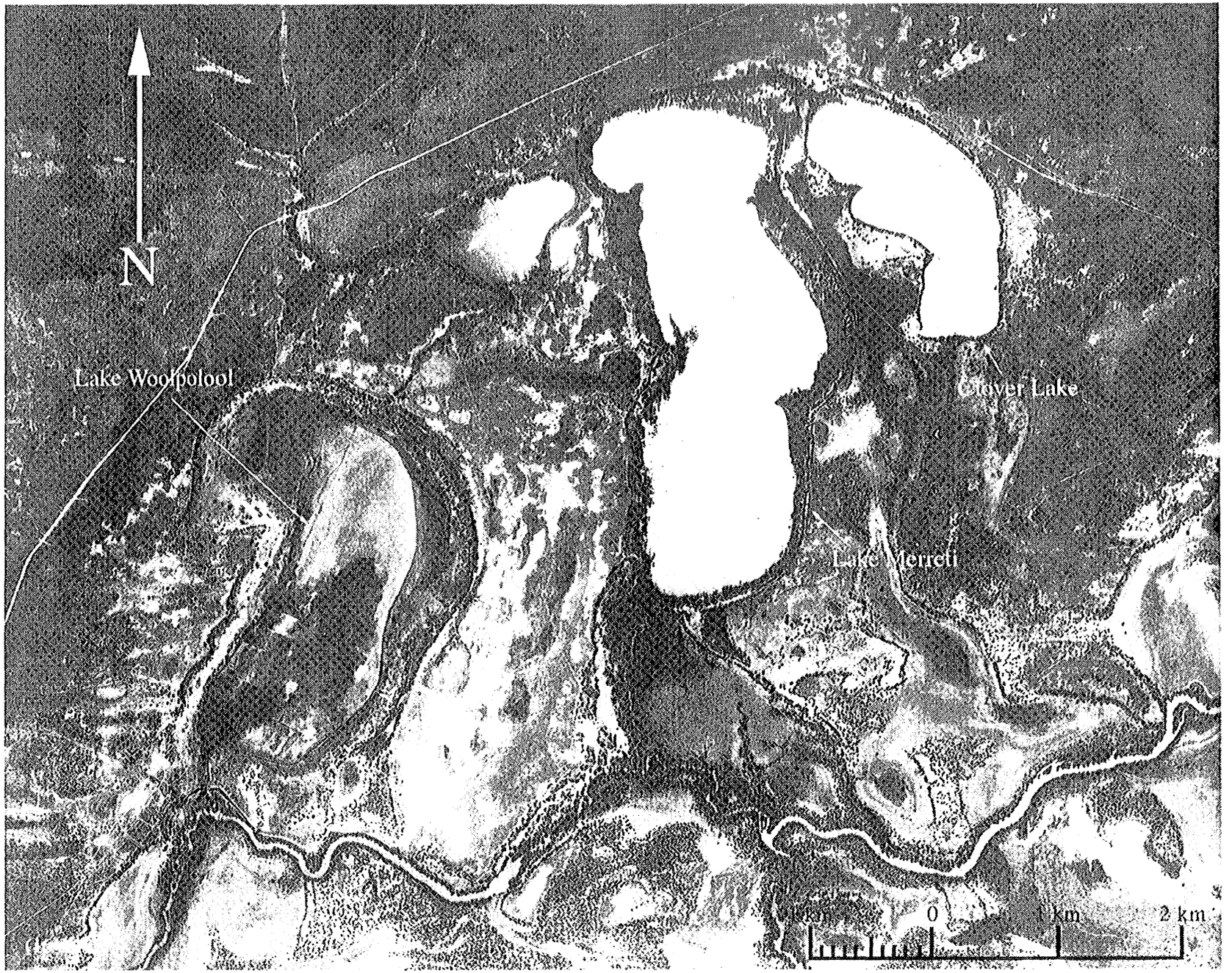
References Cited

Collingham, E.B., 1990- Chowilla hydrogeological studies by the Engineering and Water Supply Department South Australia: Technical discussion papers. Civil Section Engineering Services Group Engineering and Water Supply Department, South Australia, EWS unregistered.

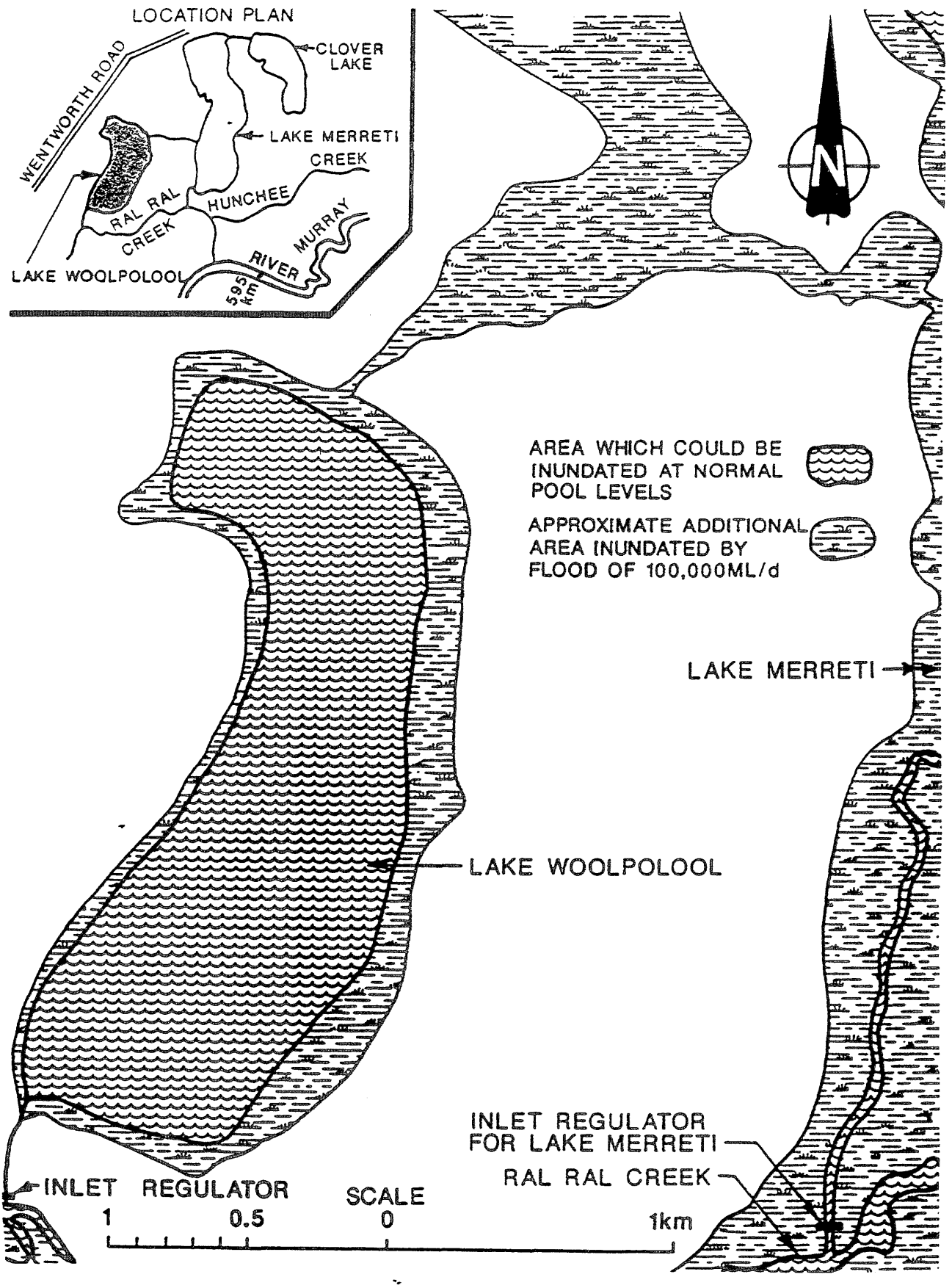
Engineering and Water Supply (E&WS) (South Australia), 1989a- Enhancing wetlands., South Australian River Murray Wetlands Working Party Report, Engineering and Water Supply Department and Department of Environment and Planning, EWS 1439/88, Report no. 88/7, 174 p.

Kernich, A.M., 1984- The climate of the River Murray and environs, South Australia., Technical report, South Australia Department of Agriculture.

Rogers, P.A., 1978- Chowilla, South Australia - 1:250 000 Geological Series., Geological Survey of South Australia, Explanatory notes, SI/54-6.


N
Lake Woolpolool
Clover Lake
Lake Merreti
0 km
0
1 km
2 km

Lake Woolpolool



(EW&S, 1989a)

<Site Name> Loveday Basin
<Synonyms>

Spatial

<**Location description**> 2 kilometres west of Loveday, SA and 4 south of Cobdogla, SA

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Renmark

<**Location 1:100 000**> Moorook 6929

<**Zone**> 54H

<**Coordinates easting (AMG)**> 444500

<**Coordinates northing (AMG)**> 6206000

<**State**> South Australia

General

<**Year begun operation**> 1972

<**Active/inactive**> Active

<**Full surface area (ha)**> 330 ha; 300 ha at 9.9 m AHD

<**Volume capacity (ML)**> 2200 ML at 9.9 m AHD

<**Full surface level (m AHD)**> 9.95 m AHD

<**Groundwater level (m AHD)**> 8-10 m AHD

<**Groundwater seepage/discharge**>

<**Average annual evaporation**> 1600-1700 mm/yr

<**Volume disposed annually (ML/yr)**> 2600 ML/yr

<**Salinity of water disposed (EC)**> 2090-5230 EC (in 1986)

<**Range of salinity in basin (EC)**> 694-2780-12,700 EC (91-93). Basin is frequently flushed, with the salinity increasing between floodings.

<**Sources of water to be disposed**> Comprehensive Drainage Scheme (CDS) of Loveday and Nookamka Division of Cobdogla Irrigation Area.

<**Terminal/throughflow basin**> Throughflow with partial flushing (1 in 2 year)

<**Range of elevation of lake surface with disposal**> 9.53 to 10.20 to 11.55 m AHD depending on river level

<**Lining/treatment of base**> None

<Site Name> Loveday Basin
<Synonyms>

<**Review of environmental impacts**> Raised saline groundwater levels in the basin area caused by the construction and operation of Weir and Lock No. 3 some 12 kilometres downstream, and the operation of the basin have brought about salinisation and degradation of the basin area. The Barmera-Moorook Region of the South Australian Field and Game Association with agency funding and support are currently undertaking an extensive rehabilitation program for the general basin area (K. Smith, pers. comm.).

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> SA Engineering and Water Supply

<**Project name**> Loveday Basin

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Banking and an outlet

Geological

<**Site description and Geomorphology**> The basin trends basically NNW-SSE and is located on the River Murray floodplain. It is a stranded meander lake and is connected to the Murray River by Blackfellows Creek and by numerous small channels. Loveday Basin is bounded on the east by an upper terrace of the Rufus Formation and on the west by the River Murray.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located east of the Hamley Fault and within the Renmark Trough (Firman, 1972).

<**Stratigraphic setting**> The basin is floored by the Coonambidgal Formation (5 m), and is underlain by the Monoman Formation (10-20 m), the Bookpurnong Beds/Winnambool Formation (20 m), the Murray Group Limestone (110 m), and the Renmark Group (200 m).

<**Host formation**> Coonambidgal Formation

<**Host lithofacies**> Grey silt, clay and some sand

<**Aquitard**> Coonambidgal Formation and Bookpurnong Beds/Winnambool Formation

<**Aquitard lithofacies**> Coonambidgal Formation: Grey silt, clay, and some sand; Bookpurnong Beds/Winnambool Formation: Dark grey silt, micaceous, and shell material

<**Aquifer**> Monoman Formation

<**Aquifer lithofacies**> Medium to coarse sand with occasional organics

<**Comments**> Loveday Basin is used preferentially (instead of Cobdogla Evaporation Basin) for irrigation drainage water disposal because of its larger surface area (EWS, 1989a).

<Site Name> Loveday Basin
<Synonyms>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> <100 metres

<**Head between basin and river/tributary**> Kept at or below river level

<**Direction of groundwater flow in regional aquifer**> West towards the Murray River (Barnett, 1991)

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**>

<**Thickness of aquitard**> Coonambidgal Formation: 5 metres; Bookpurnong Beds/Winnambool Formation: 20 metres

<**kv and kh of aquifer**> Monoman Formation: Kh = 10-20 metres/day (E. Collingham, pers. comm.)

<**EC of aquifer**>

<**Porosity of aquifer**>

<**Thickness of aquifer**> Monoman Formation: 10-20 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> Because of the large irrigation mound (22 m AHD) associated with the Cobdogla Irrigation Area, flow within the Parilla Sand (and therefore the Monoman) is directed towards the basin. Salinities are relatively low (3000-7000 EC) within the mound but the hydraulic head is high (12 metres), which all results in a concentration of groundwater within the trench and in particular within Loveday Basin. If the basin was not flushed regularly (which it is), salinities would increase because of the high amount of groundwater inflow and high evaporation. There could also be damage if the basin was kept at a higher level than the river (which it isn't), thereby allowing flow from the basin into the Monoman Formation to occur and the resulting further salinisation of the floodplain.

<**Hydraulic linkage to surface runoff**> Connected to the River Murray by Blackfellows Creek

<Site Name> Loveday Basin
<Synonyms>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

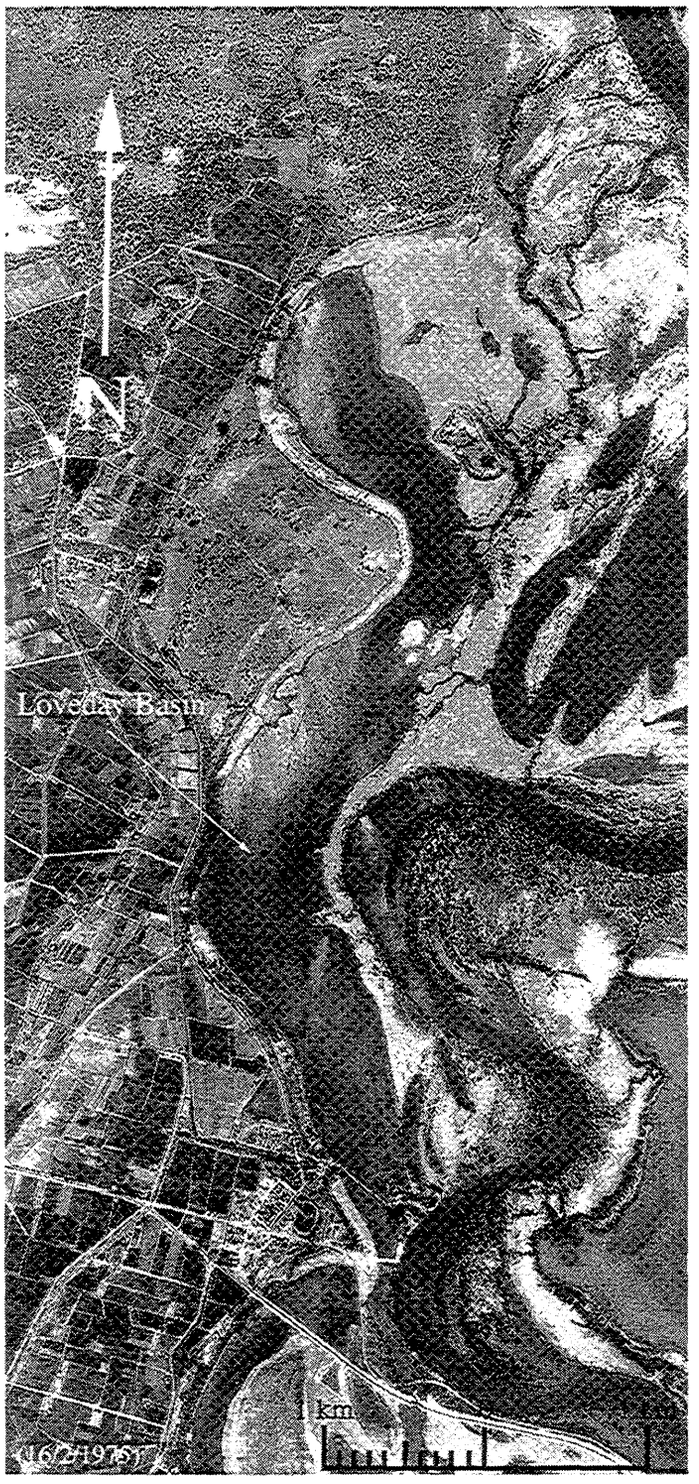
<Ranking of sustainability>

References Cited

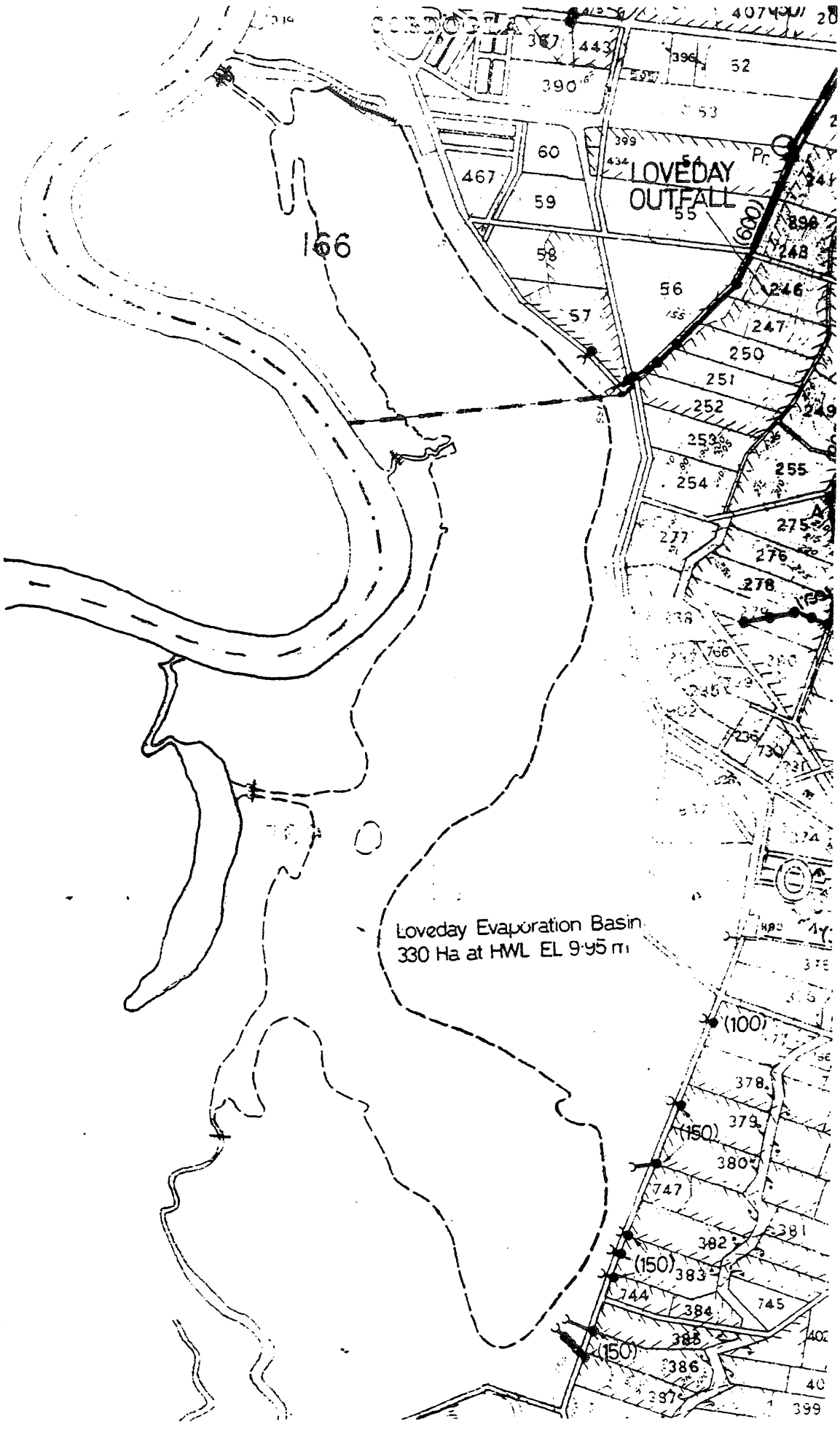
Barnett, S.R. (South Australia Department of Mines and Energy), 1991- Renmark Hydrogeologic Map (1:250 000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia

Engineering and Water Supply (E&WS) (South Australia), 1989a- Enhancing wetlands., South Australian River Murray Wetlands Working Party Report, Engineering and Water Supply Department and Department of Environment and Planning, EWS 1439/88, Report no. 88/7, 174 p.

Firman, J.B., 1972- Renmark, South Australia - 1:250 000 Geological Series., Geological Survey of South Australia, Explanatory notes, SI/54-10.


N
Loveday Basin
1 km
1 km
6/2/1978

Loveday Basin



(EW&S, Adelaide)

<Site Name> Loveday South Basin
<Synonyms>

Spatial

<**Location description**> 6 kilometres SSW of Barmera, SA and 6 kilometres east of the Murray River and Yatco Lagoon

<**Located in Murray Trench**> No

<**Location 1:250 000**> Renmark

<**Location 1:100 000**> Moorook 6929

<**Zone**> 54H

<**Coordinates easting (AMG)**> 449105

<**Coordinates northing (AMG)**> 6202750

<**State**> South Australia

General

<**Year begun operation**> Basin was to be used for expansion of Cobdogla Irrigation Area after World War II, but expansion never occurred. Today irrigators pump into the sandhills to get rid of drainage water.

<**Active/inactive**> Active

<**Full surface area (ha)**> 2-3 ha

<**Volume capacity (ML)**> 600 ML

<**Full surface level (m AHD)**> >20 m AHD

<**Groundwater level (m AHD)**> 12 m AHD (Barnett, 1991)

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> 1600-1700 mm/yr

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**>

<**Sources of water to be disposed**> Comprehensive Drainage Scheme water from Cobdogla Irrigation Area

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**>

<**Review of environmental impacts**>

<Site Name> Loveday South Basin
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> SA Engineering and Water Supply

<**Project name**> Loveday South Basin

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**>

Geological

<**Site description and Geomorphology**> The basin is located between Woorinen dunes surrounded by cleared and uncleared mallee on a peninsula of land (10-15 kilometres wide) surrounded by the Murray River.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located east of the Renmark Trough and west of the Paringa Embayment (Firman, 1972).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (5 m), and is underlain by the Blanchetown Clay? (5-10 m), the Parilla Sand (30-40 m), the Bookpurnong Beds (10 m), the Murray Group Limestone (110 m), and the Renmark Beds (250 m).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Yellow brown fine to medium sand with calcrete deposits on ridges

<**Aquitard**> Blanchetown Clay

<**Aquitard lithofacies**> Grey clay and silty clay

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Firn to medium quartz sand

<**Comments**> Presence of the Blanchetown Clay is interpreted only until bore data is received.

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 6 kilometres to Murray River

<**Head between basin and river/tributary**> at least 10 metres

<**Direction of groundwater flow in regional aquifer**> Regional flow has been hijacked by the

<**Site Name**> Loveday South Basin
<Synonyms>

Cobdogla Irrigation Mound with flow now going south away from irrigation area.

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Blanchetown Clay: 5-10 metres

<kv and kh of aquifer> Parilla Sand: Kh = 5-10 metres/d

<EC of aquifer> Parilla Sand: 6,000-7,000 EC? (Irrigation water)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 30 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Cobdogla Irrigation Area has developed a large (22 m AHD) groundwater mound that has changed the hydrologic regime in the area into flow away from the mound rather than towards the river (although on the western side of the mound, not only is there flow toward the river but is increased). Because Loveday Basin South has only private irrigators disposing drainage water, flows are never large enough to create significant problems. If disposal would increase in the future, problems would be encountered due to the high conductivity of the Woorinen Formation (perched aquifer). This would lead to groundwater leaving the basin as quickly as it is pumped in and subsequent salinisation of low lying areas around the basin. There may also be recharge into the Parilla Sand depending on the lithology and thickness of the Blanchetown Clay. However, compared to the recharge of the Parilla due to accession of irrigation water the amount should be low and should not affect the river.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> Loveday South Basin
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

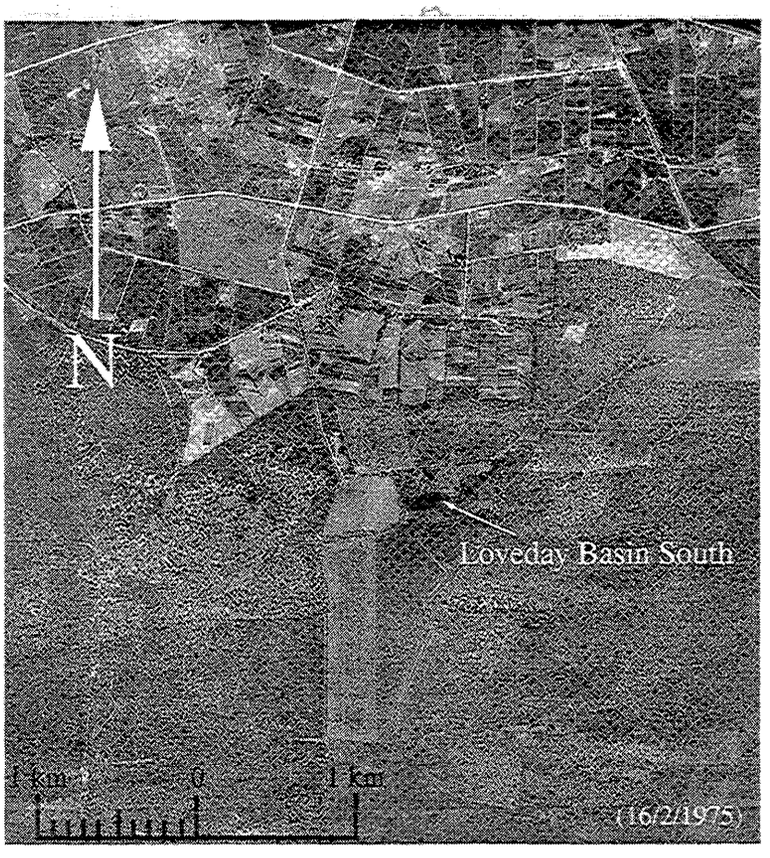
Interpretive 2

<Ranking of sustainability>

References Cited

Barnett, S.R. (South Australia Department of Mines and Energy), 1991- Renmark Hydrogeologic Map (1:250 000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia

Firman, J.B., 1972- Renmark, South Australia - 1:250 000 Geological Series., Geological Survey of South Australia, Explanatory notes, SI/54-10.


N
Loveday Basin South
1 km
0
1 km
(16/2/1975)

<Site Name> Lyrup East Basin
<Synonyms>

Spatial

<Location description> 500 metres NE of Lyrup, SA on small feeder stream of the Murray River

<Located in Murray Trench> Yes

<Location 1:250 000> Renmark

<Location 1:100 000> Renmark 7029

<Zone> 54H

<Coordinates easting (AMG)> 468750

<Coordinates northing (AMG)> 6209600

<State> South Australia

General

<Year begun operation> 1964

<Active/inactive> Active

<Full surface area (ha)> 9.3 ha; 5 ha at 13.2 m AHD

<Volume capacity (ML)>

<Full surface level (m AHD)> 13.3 m AHD

<Groundwater level (m AHD)> 15 m AHD (Barnett, 1991)

<Groundwater seepage/discharge> Discharge

<Average annual evaporation> Regional: 2250 mm/yr (Kernich, 1984); Local: 1600-1700 mm/yr (K. Smith, pers. comm.)

<Volume disposed annually (ML/yr)> 6 ML

<Salinity of water disposed (EC)> 850-3860 EC (1987)

<Range of salinity in basin (EC)> 320-37,300 (January, 1988)

<Sources of water to be disposed> Lyrup Village Association Comprehensive Drainage Scheme

<Terminal/throughflow basin> Throughflow and flushed during high flows; ARI of floods 1:3

<Range of elevation of lake surface with disposal> 12.97 to 14.00 m AHD

<Lining/treatment of base>

<Review of environmental impacts> The general area of the basin was initially salinised but has improved in recent years with some regeneration of vegetation occurring between the irrigators' properties and the basin (K. Smith, pers. comm.).

<Site Name> Lyrup East Basin
<Synonyms>

Engineering/Admin

<**Public or private operation**> Private

<**Agency responsible**> Lyrup Village Association

<**Project name**> Lyrup East Basin

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> The basin is a creek that has been blocked off at the river mouth to form a basin.

Geological

<**Site description and Geomorphology**> The basin is located on the floodplain of the Murray River and is developed in the Coonambidgal Formation. It is bounded on the south by an upper terrace of the River Murray and on the north by the River Murray. It appears to be a channel developed between ridges in a point bar complex, that was blocked off to form the basin.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located east of the Hamley Fault and lies within the Renmark Trough (Firman, 1972).

<**Stratigraphic setting**> The basin is floored by the Coonambidgal Formation (5 m), and is underlain by the Monoman Formation (20 m), the Bookpurnong Beds (20 m), the Murray Group Limestone (110 m), and the Renmark Group (225 m) (Geology interpreted from Barnett, 1992).

<**Host formation**> Coonambidgal Formation

<**Host lithofacies**> Clay, silts, and sand

<**Aquitard**> Coonambidgal Formation and Bookpurnong Beds

<**Aquitard lithofacies**> Coonambidgal Formation: Clays, silts, and sand; Bookpurnong Beds: Dark grey brown shelly silts and clays

<**Aquifer**> Monoman Formation and Murray Group Limestone

<**Aquifer lithofacies**> Monoman Formation: Medium to coarse sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> separated by outlet channel

<Site Name> Lyrup East Basin
<Synonyms>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> North towards the Murray River (Barnett, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard> Bookpurnong Beds: Kv = 10^{-3} to 10^{-7} metres/day (Barnett, 1992)

<Thickness of aquitard> Coonambidgal Formation: 5 metres; Bookpurnong Beds: 20 metres

<kv and kh of aquifer> Parilla Sand: Kh = 10-20 metres/day

<EC of aquifer>

<Porosity of aquifer>

<Thickness of aquifer> Monoman Formation: 20 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin is located on a sandy portion of the floodplain, and may thus have a direct connection with the underlying Monoman Formation. However, leakage from the basin should be low due to the small amount of water disposed and because of the upwards gradient of the Monoman Formation due to the irrigation mound beneath Lyrup. However, if the basin is kept at a higher level than the mean river height there could be sufficient head to cause salinisation of the floodplain between the basin and the river.

<Hydraulic linkage to surface runoff> Separated from the river by an outlet.

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Site Name> Lyrup East Basin
<Synonyms>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Barnett, S.R., 1992- Regional hydrogeology of the Loxton-Noora area, Murray basin, South Australia., South Australia Department of Mines and Energy, Geological Survey, Report Book 92/15, 6 p.

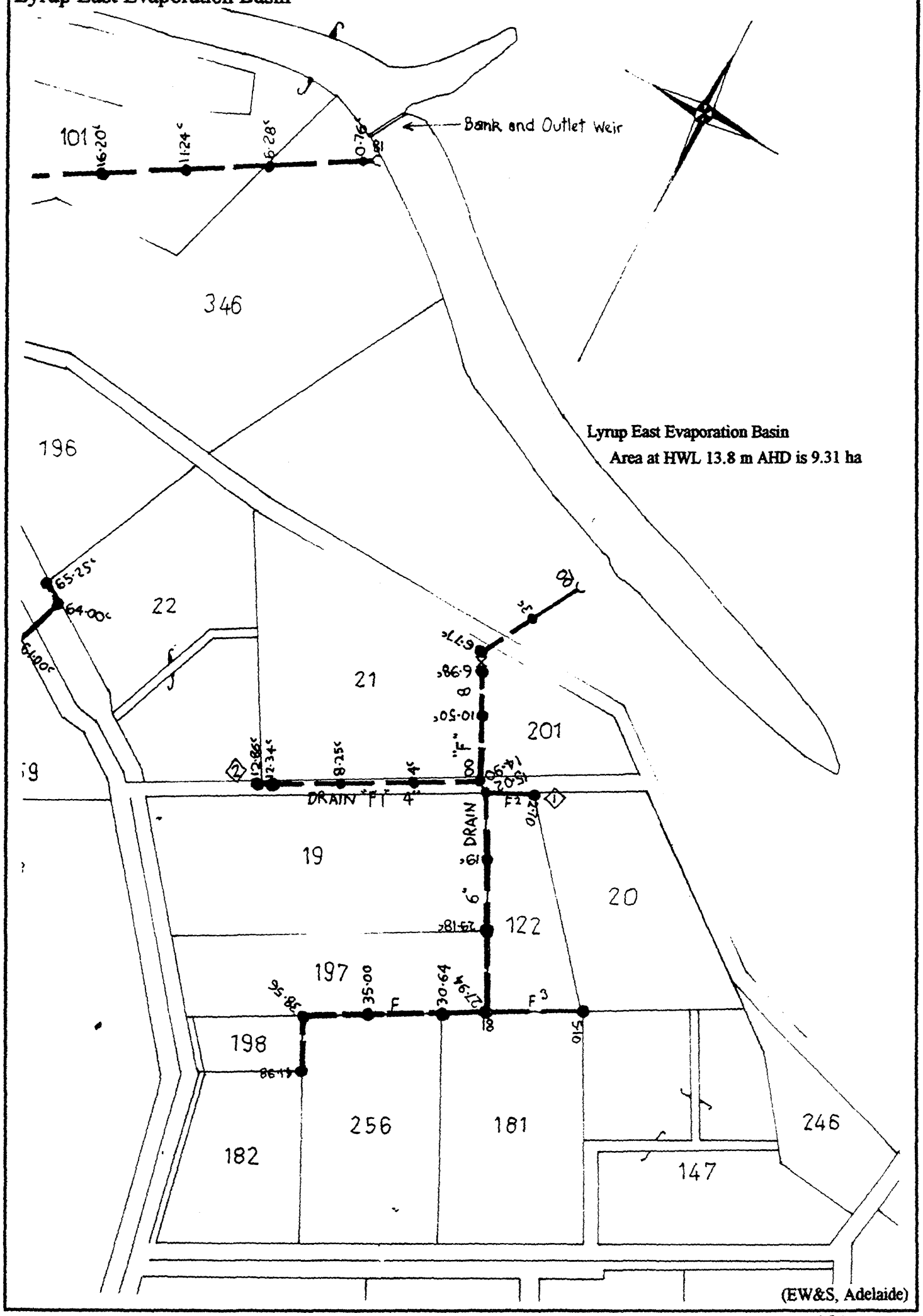
Barnett, S.R. (South Australia Department of Mines and Energy), 1991- Renmark Hydrogeologic Map (1:250 000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia

Firman, J.B., 1972- Renmark, South Australia - 1:250 000 Geological Series., Geological Survey of South Australia, Explanatory notes, SI/54-10.

Kernich, A.M., 1984- The climate of the River Murray and environs, South Australia., Technical report, South Australia Department of Agriculture.


N
Lyrup East
Lyrup South
(16/2/1975)

Lyrup East Evaporation Basin



(EW&S, Adelaide)

<Site Name> Lyrup South Basin
<Synonyms>

Spatial

<**Location description**> 1 kilometre south of Lyrup, SA, 4 kilometres east of Berri, SA (across Spring Cart Reach) and 2 kilometres NW of Gurra Gurra Lake

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Renmark

<**Location 1:100 000**> Renmark 7029

<**Zone**> 54H

<**Coordinates easting (AMG)**> 468000

<**Coordinates northing (AMG)**> 6207500

<**State**> South Australia

General

<**Year begun operation**> 1964

<**Active/inactive**> Active

<**Full surface area (ha)**> 56.7 ha; 40 ha at 14.5 m AHD

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> 14.74 m AHD

<**Groundwater level (m AHD)**> 15 m AHD

<**Groundwater seepage/discharge**> Discharge?

<**Average annual evaporation**> Regional: 2250 mm/yr (Kernich, 1984); Local: 1600-1700 mm/yr (K. Smith, pers. comm.)

<**Volume disposed annually (ML/yr)**> 100 ML/yr

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**>

<**Sources of water to be disposed**> Comprehensive Drainage Scheme (CDS) water from Lyrup Village

<**Terminal/throughflow basin**> Isolated from the floodplain by banking; ARI of flooding 1:100

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**>

<**Review of environmental impacts**> The basin has been isolated from flooding since its inception, and now presents a stark, barren, severely salinised landscape. Rehabilitation of the basin area would be extremely difficult (K. Smith, pers. comm.).

<Site Name> Lyrup South Basin
<Synonyms>

Engineering/Admin

<**Public or private operation**> Private

<**Agency responsible**> Lyrup Village Association

<**Project name**> Lyrup South Basin

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Inlet in north and northeastern corner and banking across floodplain

Geological

<**Site description and Geomorphology**> The basin is a stranded meander? cut into the upper river terrace, that has been dammed off by a retaining wall across the floodplain. It has a small island of upper river terrace in the middle of the basin, and is bounded by the upper river terrace (Rufus Terrace) on the north, east and south, and by the river to the west.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located east of the Hamley Fault, and within the Renmark Trough (Firman, 1972).

<**Stratigraphic setting**> The basin is floored by the Coonambidgal Formation (5 m) (possibly Yamba Formation), and is underlain by the Monoman Formation (20-30 m), the Bookpurnong Beds (10-20 m), the Murray Group Limestone (110 m), and the Renmark Group (220 m).

<**Host formation**> Coonambidgal Formation

<**Host lithofacies**> Organic, grey silts, clays, and sands

<**Aquitard**> Coonambidgal Formation and Bookpurnong Beds

<**Aquitard lithofacies**> Coonambidgal Formation: Organic, grey silts, clays, and sands; Bookpurnong Beds: Dark grey brown shelly silts and clays

<**Aquifer**> Monoman Sand

<**Aquifer lithofacies**> Fine to medium quartz sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 2 kilometres

<**Head between basin and river/tributary**> 1 metre

<**Direction of groundwater flow in regional aquifer**> East to the Murray River (Barnett, 1991)

<Site Name> Lyrup South Basin
<Synonyms>

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard> Bookpurnong Beds: Kv = 10^{-3} to 10^{-7} m/d (Barnett, 1992)

<Thickness of aquitard> Coonambidgal Formation: 5 metres; Bookpurnong Beds: 10-20 metres

<kv and kh of aquifer> Monoman Formation: Kh = 10-20 metres/day

<EC of aquifer>

<Porosity of aquifer>

<Thickness of aquifer> Monoman Formation: 30 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin probably receives groundwater flow from the small irrigation mound (2-3 m) associated with Lyrup Village Settlement. Increased groundwater flow into the basin and the addition of disposal water has increased the salinities in the basin to very high levels. Air photos show expanses of salt flats in the basin suggesting that it does dry up completely. Compared with adjacent river flats, vegetation is sparse suggesting that the ground has been salinised.

<Hydraulic linkage to surface runoff> Basin floods during high flows (1:100 years)

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

<Site Name> Lyrup South Basin
<Synonyms>

Interpretive 2

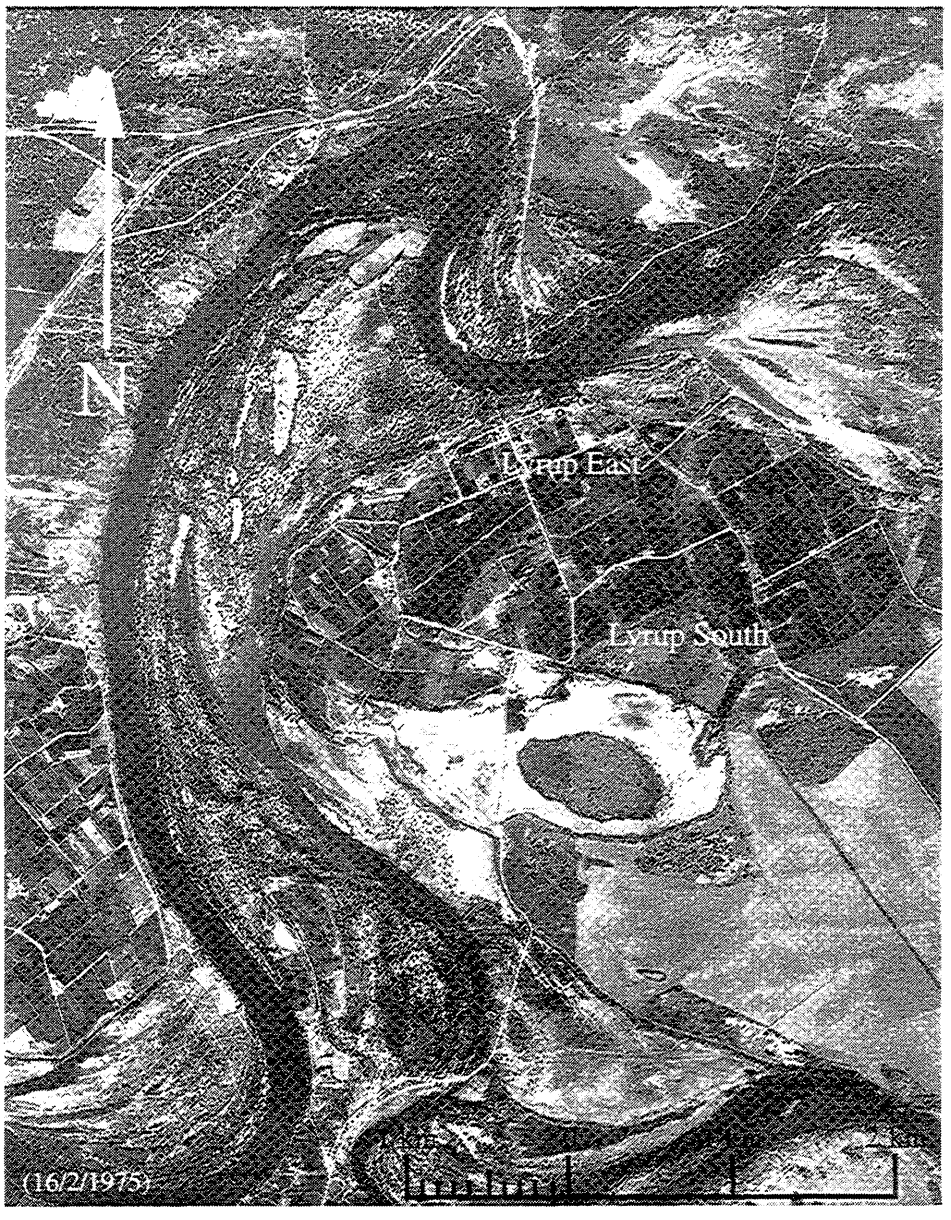
<Ranking of sustainability>

References Cited

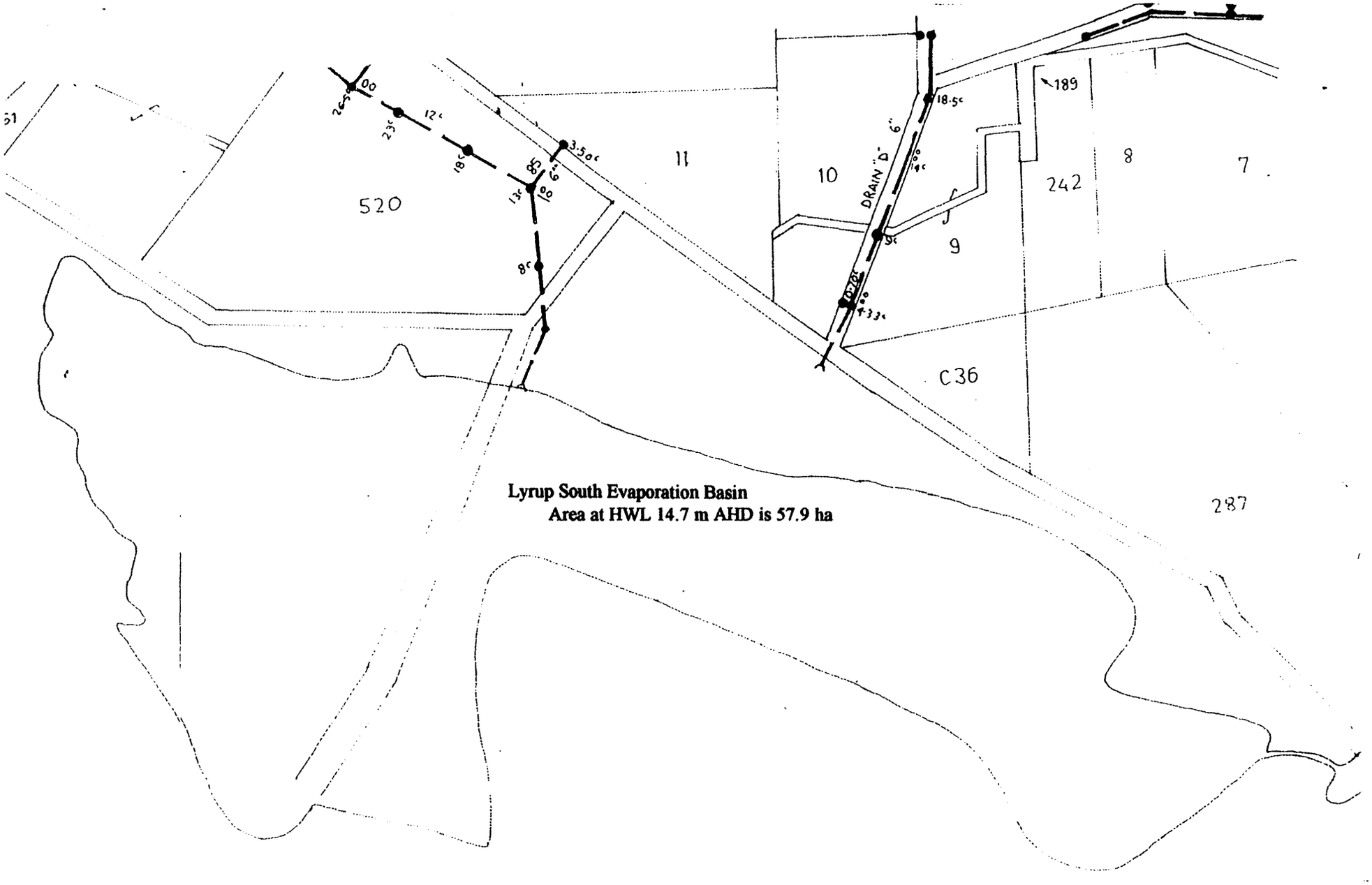
Barnett, S.R., 1992- Regional hydrogeology of the Loxton-Noora area, Murray basin, South Australia., South Australia Department of Mines and Energy, Geological Survey, Report Book 92/15, 6 p.

Firman, J.B., 1972- Renmark, South Australia - 1:250 000 Geological Series., Geological Survey of South Australia, Explanatory notes, SI/54-10.

Kernich, A.M., 1984- The climate of the River Murray and environs, South Australia., Technical report, South Australia Department of Agriculture.


N
Lyrup East
Lyrup South
(16/2/1975)

Lyrup South Evaporation Basin



(EW&S, Adelaide)

<Site Name> Meander Loop
<Synonyms> Rufus River Interception Scheme

Spatial

<Location description> Adjacent to Lake Victoria, NSW

<Located in Murray Trench> Yes

<Location 1:250 000> Mildura

<Location 1:100 000> Lindsay 7129

<Zone> 54H

<Coordinates easting (AMG)> 525000

<Coordinates northing (AMG)> 6232300

<State> New South Wales

General

<Year begun operation> 1984

<Active/inactive> Active

<Full surface area (ha)> 3 ha at 20.9 m AHD

<Volume capacity (ML)>

<Full surface level (m AHD)> 20.9 m AHD

<Groundwater level (m AHD)> 27 m AHD (E&WS, 1994)

<Groundwater seepage/discharge> Discharge from mound associated with Lake Victoria

<Average annual evaporation> Inflow/evaporation 2600 ML:3300 ML (excess pumped to Rufus River)

<Volume disposed annually (ML/yr)> 3300 ML/yr

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)> < 5,000 mg/L (flooded); mean 5,000-10,000 mg/L (E&WS, 1994)

<Sources of water to be disposed> Groundwater mound from Lake Victoria, pumping stations, and relift from Brilka Creek Basin

<Terminal/throughflow basin> Throughflow (pumped to Rufus River)

<Range of elevation of lake surface with disposal>

<Lining/treatment of base>

<Review of environmental impacts>

<Site Name> Meander Loop
<Synonyms> Rufus River Interception Scheme

Engineering/Admin

<Public or private operation> Public

<Agency responsible> SA Engineering and Water Supply and Mid Pike Irrigators

<Project name> Meander Loop

<Natural, modified natural or constructed> Modified natural

<Modification type and degree>

Geological

<Site description and Geomorphology> The basin is a meander loop of the River Murray that now intercepts large volumes of water due the groundwater mound associated with Lake Victoria (E&WS, 1994).

<Subsurface investigations at site>

<Structural setting> The basin is located northeast of the Wentworth Trough and southeast of the Renmark Trough (RWC, 1991).

<Stratigraphic setting> The basin is floored by the Coonambidgal Formation (3-7 m), and is underlain by the Channel Sand (3-11 m), the Parilla Sand (30-50 m), and the Bookpurnong Beds (interpreted from RWC, 1991)

<Host formation> Coonambidgal Formation

<Host lithofacies> Silty clay and clay

<Aquitard> Coonambidgal Formation

<Aquitard lithofacies> Coonambidgal Formation: silty clay and clay

<Aquifer> Channel Sand and Parilla Sand

<Aquifer lithofacies> Channel Sand and Parilla Sand: Medium to coarse quartz sand

<Comments>

<Site Name> Meander Loop
<Synonyms> Rufus River Interception Scheme

Summary of Hydrodynamics

<Distance to Murray or tributary> 1 kilometre

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Southwest towards the river (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Coonambidgal Formation: 3-7 metres

<kv and kh of aquifer>

<EC of aquifer>

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 30 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer>The artificial raising of water levels in Lake Victoria has acted to increase the groundwater mound in the Parilla Sand aquifer by up to 7 metres and has greatly increased saline groundwater flow towards the Murray River. The Rufus River Interception Scheme acts to intercept this water and prevent it from entering the river. Meander Loop Basin is part of this system and acts to hold water intercepted from Brilka Creek as well as water pumped from interception bores until it can be pumped to Rufus River Basin. The basin also intercepts large quantities of groundwater due its position adjacent to Lake Victoria (E&WS, 1994)

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> Meander Loop
<**Synonyms**> Rufus River Interception Scheme

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

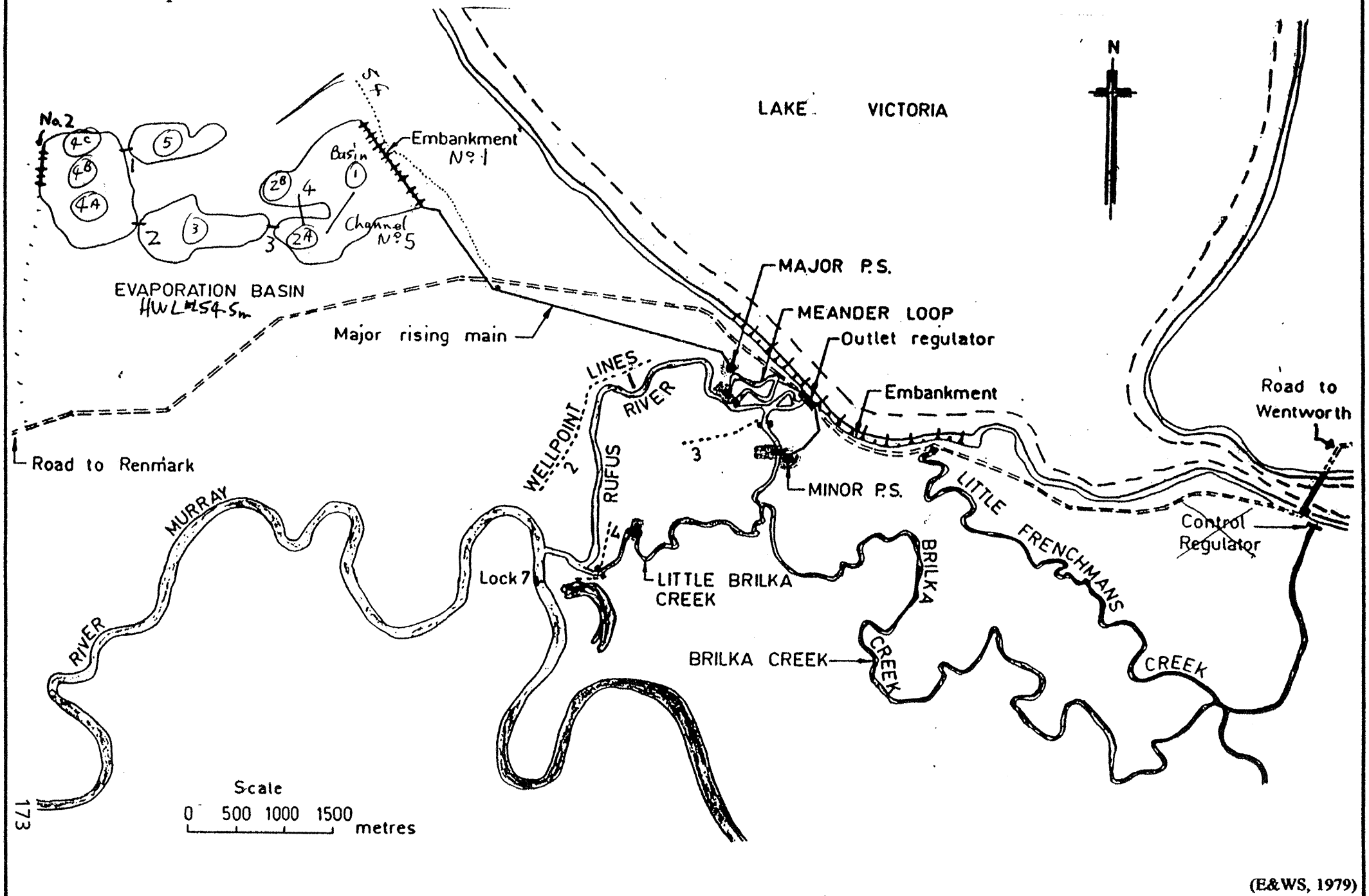
Barnett, S.R. (South Australia Department of Mines and Energy), 1991- Renmark Hydrogeologic Map (1:250 000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia

Firman, J.B., 1972- Renmark, South Australia - 1:250 000 Geological Series., Geological Survey of South Australia, Explanatory notes, SI/54-10.

South Australia Engineering and Water Supply (E&WS) 1994- Evaluation of Saline Water Disposal Basins along the River Murray between Lock 1 and Lake Victoria, SA Engineering and Water Supply, Draft 94/1

N
Meander Loop
Britka Creek

Rufus River Disposal Basin



<Site Name> Mid Pike
<Synonyms>

Spatial

<Location description> 8 kilometres north of Noora Disposal Basin and 13 kilometres east of Lyrup Heights, SA

<Located in Murray Trench> No

<Location 1:250 000> Renmark

<Location 1:100 000> Renmark 7029

<Zone> 54H

<Coordinates easting (AMG)> 484500

<Coordinates northing (AMG)> 6206500

<State> South Australia

General

<Year begun operation> 1950's

<Active/inactive> Active

<Full surface area (ha)> 30 ha at 15 m AHD

<Volume capacity (ML)>

<Full surface level (m AHD)> 15 m AHD

<Groundwater level (m AHD)> 15-16 m AHD (Barnett, 1991)

<Groundwater seepage/discharge> Discharge from irrigation land

<Average annual evaporation> 1600-17000 mm/yr (K. Smith, pers. comm.); Inflow/evaporation < 0.2 (E&WS, 1994)

<Volume disposed annually (ML/yr)> 12 ML/yr

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)> 35,000-50,000 mg/L (E&WS, 1994)

<Sources of water to be disposed> Saline groundwater from irrigation mound

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base>

<Review of environmental impacts>

<Site Name> Mid Pike
<Synonyms>

Engineering/Admin

<Public or private operation> Public

<Agency responsible> SA Engineering and Water Supply and Mid Pike Irrigators

<Project name> Mid Pike

<Natural, modified natural or constructed> Modified natural

<Modification type and degree>

Geological

<Site description and Geomorphology> Part of the large Yamba saline discharge complex and surrounded by irrigated horticulture (E&WS, 1994).

<Subsurface investigations at site>

<Structural setting> The basin is located east of the Renmark Trough and within the Paringa Embayment (Firman, 1972).

<Stratigraphic setting> The basin is floored by the Yamba Formation (5 m), and is underlain the Parilla Sand (30 m), the Bookpurnong Beds (20 m), the Murray Group Limestone (110 m), and the Renmark Group (200 m) (Geology interpreted from Barnett, 1991).

<Host formation> Yamba Formation

<Host lithofacies> Lacustral clay, gypsum and halite

<Aquitard> Yamba Formation and Bookpurnong Beds

<Aquitard lithofacies> Yamba Formation: Lacustral clay, gypsum and halite; Bookpurnong Beds: Grey brown shelly silts and clays

<Aquifer> Parilla Sand

<Aquifer lithofacies> Parilla Sand: Medium to coarse quartz sand

<Comments>

<Site Name> Mid Pike
<Synonyms>

Summary of Hydrodynamics

<Distance to Murray or tributary> 1 kilometre

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Into the Yamba Complex (Barnett,1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard> Bookpurnong Beds: 10^{-3} to 10^{-6} m/day (Barnett, 1992)

<Thickness of aquitard> Yamba Formation: 5 metres; Bookpurnong Beds: 20-30 metres

<kv and kh of aquifer>

<EC of aquifer> Parilla Sand: 35,000 to 100,000 mg/L (Barnett, 1991)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 30 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Groundwater discharges from the Parilla Sand into the Yamba saline complex. The groundwater flow is further enhanced due to the intensive horticulture surrounding the basin, although the local irrigators are attempting to decrease the amount of disposal. Problems would only occur if flow into the basin was increased sufficeintly to overwhelm the evaporation capacity of the basin (~60 ML/yr) thus raising the local groundwater levels (E&WS, 1994)

<Hydraulic linkage to surface runoff> Connected to the river by an outlet

<Category - hydraulic stability>

<Site Name> Mid Pike
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Barnett, S.R. (South Australia Department of Mines and Energy), 1991- Renmark Hydrogeologic Map (1:250 000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia

Firman, J.B., 1972- Renmark, South Australia - 1:250 000 Geological Series., Geological Survey of South Australia, Explanatory notes, SI/54-10.

South Australia Engineering and Water Supply (E&WS) 1994- Evaluation of Saline Water Disposal Basins along the River Murray between Lock 1 and Lake Victoria, SA Engineering and Water Supply, Draft 94/1


N
Mid Pike
1 km
1 km
2 km
(162/1975)

<**Site Name**> Moorook Comprehensive Drainage Scheme
<**Synonyms**> Wachtels Lagoon

Spatial

<**Location description**> Immediately northeast of Moorook Irrigation Area

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Renmark

<**Location 1:100 000**> Moorook 6929

<**Zone**> 54H

<**Coordinates easting (AMG)**> 441500

<**Coordinates northing (AMG)**> 6207600

<**State**> South Australia

General

<**Year begun operation**> 1920's

<**Active/inactive**> Active

<**Full surface area (ha)**> 600 ha at 9.8 m AHD (Lock 3 pool level)

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> 9.8 m AHD (Lock 3 pool level)

<**Groundwater level (m AHD)**>

<**Groundwater seepage/discharge**> Discharge from irrigation mound under Moorook Irrigation Area and private irrigators on west side of lagoon

<**Average annual evaporation**> Regional: 2250 mm/yr (Kernich, 1984); Local: 1600-1700 mm/yr (K. Smith, pers. comm.)

<**Volume disposed annually (ML/yr)**> 80 ML/yr

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**>

<**Sources of water to be disposed**> Receives Moorook Comprehensive Drainage Scheme Water and drainage water from adjacent private irrigation

<**Terminal/throughflow basin**> Floodplain discharge; ARI of floods 1:2

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**> The floodplain south of the lagoon is badly salinised due to raised saline watertables. The western perimeter is salinised due to seepage inflows from the irrigation mounds (K. Smith, pers. comm.).

<Site Name> Moorook Comprehensive Drainage Scheme
<Synonyms> Wachtels Lagoon

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> SA Engineering and Water Supply

<**Project name**> Wachtels Lagoon

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**>

Geological

<**Site description and Geomorphology**> Disposal is onto a floodplain south of the lagoon and directly into Wachtels Lagoon as well. The disposal site is flooded regularly (1 in 2 year event), and contains no vegetation (could be natural, man-made clearing, or disposal related).

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located east of the Hamley Fault and lies within the Renmark Trough (Firman, 1972).

<**Stratigraphic setting**> The basin is floored by the Coonambidgal Formation (5 m), and underlain by the Monoman Formation(20-30 m), the Bookpurnong Beds (5 m), the Murray Group Limestone (110 m), and the Renmark Group (240 m).

<**Host formation**> Coonambidgal Formation

<**Host lithofacies**> Grey clays, silts, and river sand

<**Aquitard**> Coonambidgal Formation and Bookpurnong Beds

<**Aquitard lithofacies**> Coonambidgal Formation: Grey clays, silts, and river sand; Bookpurnong Beds: Dark grey brown shelly silts and clays

<**Aquifer**> Monoman Formation

<**Aquifer lithofacies**> Medium to coarse quartz sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> Wachtels Lagoon is a large shallow backwater with a very wide permanent connection with the River Murray (K. Smith, pers. comm.)

<Site Name> Moorook Comprehensive Drainage Scheme
<**Synonyms**> Wachtels Lagoon

<**Head between basin and river/tributary**> 1-2 metres

<**Direction of groundwater flow in regional aquifer**> Northeast to the Murray River (Barnett, 1991)

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**> Bookpurnong Beds: Kv = 10^{-3} to 10^{-6} m/d (Barnett, 1992); although the effect of the aquitard in separating the Monoman Formation from the Murray Group Limestone may be low due to down cutting of the Bookpurnong Beds, by the River Murray.

<**Thickness of aquitard**> Coonambidgal Formation: 5 metres; Bookpurnong Beds: 5 metres

<**kv and kh of aquifer**> Monoman Formation: Kh = 10-20 m/d

<**EC of aquifer**>

<**Porosity of aquifer**>

<**Thickness of aquifer**> Monoman Formation: 20-30 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> The actual effect of the disposal onto the floodplain south of the lagoon is unknown, although it is expected that recharge into the Monoman Formation would be low with most of the water going directly into Wachtels Lagoon and the Murray River. Impact of the basin should be low because the salinity of the water (unknown) should be on the order of 1000-2000 EC and the volume disposed annually is relatively low (80 ML).

<**Hydraulic linkage to surface runoff**> Disposal water drains into Wachtels Lagoon and the Murray River.
<**Category - hydraulic stability**>

<**Category - degree of hydraulic isolation**>

<Site Name> Moorook Comprehensive Drainage Scheme
<Synonyms> Wachtels Lagoon

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Barnett, S.R., 1992- Regional hydrogeology of the Loxton-Noora area, Murray basin, South Australia., South Australia Department of Mines and Energy, Geological Survey, Report Book 92/15, 6 p.

Engineering and Water Supply Department (E&WS) (South Australia), 1982b- Moorook Irrigation Area revised rehabilitation of irrigation scheme, Riverland region., EWS 82/49, 30 p.

Firman, J.B., 1972- Renmark, South Australia - 1:250 000 Geological Series., Geological Survey of South Australia, Explanatory notes, SI/54-10.

Kernich, A.M., 1984,- The climate of the River Murray and environs, South Australia., Technical report, South Australia Department of Agriculture.


Kingston Irrigation Area
Moorook C.D.S.
(Wachtels Lagoon)
1 km
0
1 km
2 km

<Site Name> Murrayview
<Synonyms>

Spatial

<Location description> West of Murrayview, SA along the River Murray and 8 kilometres NW of Waikerie, SA

<Located in Murray Trench> Yes

<Location 1:250 000> Renmark

<Location 1:100 000> Morgan 6829

<Zone> 54H

<Coordinates easting (AMG)> 402850

<Coordinates northing (AMG)> 6224600

<State> South Australia

General

<Year begun operation> 1993

<Active/inactive> Active

<Full surface area (ha)> < 1 ha

<Volume capacity (ML)>

<Full surface level (m AHD)>

<Groundwater level (m AHD)> 8-10 m AHD (Barnett, 1991)

<Groundwater seepage/discharge>Seepage

<Average annual evaporation> Regional: 2250 mm/yr (Kernich, 1984); Local: 1600-1700 mm/yr

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)> < 5000 mg/L (E&WS, 1994)

<Sources of water to be disposed> On farm dispsoal from Section 456

<Terminal/throughflow basin>

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> Clay

<Review of environmental impacts>

<Site Name> Murrayview
<Synonyms>

Engineering/Admin

<Public or private operation> Private

<Agency responsible> SA Engineering and Water Supply

<Project name> Murrayview

<Natural, modified natural or constructed>Constructed

<Modification type and degree>

Geological

<Site description and Geomorphology> Locatedon the edge of the trench (E&WS, 1994)

<Subsurface investigations at site>

<Structural setting> In Murray Trench west of the Morgan Fault and east of the Encounter Fault Zone (Firman, 1972).

<Stratigraphic setting> The basin is floored by the Coonambidgal Formation (3 m), and is underlain by the Monoman Formation (10-15 m), the Cadell Marl (1.5 m), the Upper Murray Group Limestone (10-15 m), the Finnis Clay (0-4 m), the Lower Murray Group Limestone (110 m), the Ettrick Clay, the Renmark Group (40 m) (Coffey, 1988; and EWS bore logs, unpublished).

<Host formation> Coonambidgal Formation

<Host lithofacies> Clays and silts

<Aquitard> Coonambidgal Formation, Cadell Marl, and Finnis Clay

<Aquitard lithofacies> Coonambidgal Formation: Grey clay, black silty clay, and puggy silt; Cadell Marl: calcareous clay; Finnis Clay: Marls, marly limestone, and bryozoal remains (Coffey, 1988)

<Aquifer> Monoman Formation and Upper Murray Group Limestone

<Aquifer lithofacies> Monoman Formation: Medium to coarse quartz sand; Upper Murray Group Limestone: calcarenite

<Comments>

Summary of Hydrodynamics

<Distance to Murray or tributary> On floodplain

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> East to the Murray River (Barnett, 1991)

<kv of artificial floor>

<kv and kh of host>

<Site Name> Murrayview
<Synonyms>

<kv and kh of aquitard> Cadell Marl: Kv = 2 x 10^{-4} m/d ; Finnis Clay: Kv = 3 x 10^{-3} m/d (Telfer and Watkins, 1991)

<Thickness of aquitard> Coonambidgal Formation: 3 metres; Cadell Marl: 1.5 metres; Finnis Clay: 0-4 metres

<kv and kh of aquifer> Murray Group Limestone: Kv = 1.5 to 2.25 m/day, Kh = 0.15 to 1.08 m/day; Renmark Group: Kh = 1.8 m/day (Coffey, 1988); Upper Murray Group Limestone: Transmissivity = 250 m^2/d (Telfer and Watkins, 1991)

<EC of aquifer> Murray Group Limestone: 1385-29,600 EC depending on proximity to irrigation recharge, Monoman Formation: 36,000 EC (Coffey, 1988); Upper Murray Group Limestone: 10,000-20,000 mg/L (generally lower salinities prevail due to flushing from the irrigation areas), Lower Murray Group Limestone: 28,800 mg/L (less irrigation effects due to 'protection' by the Finnis Clay, the exception is at Waikerie Bend, where a long history of irrigation has lowered the salinities to less than 10,000 mg/L) (Telfer and Watkins, 1991).

<Porosity of aquifer>

<Thickness of aquifer> Monoman Formation: 10-15 metres; Upper Murray Group Limestone: 10 metres; Lower Murray Group Limestone: 110 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Smith (1994) estimates that the basin has a leakage potential of 1-2 metres, but with the good clay seal under the basin leakageshould be minimal.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Barnett, S.R. (South Australia Department of Mines and Energy), 1991- Renmark Hydrogeologic Map (1:250 000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia

<Site Name> Murrayview
<Synonyms>

Coffey and Partners Pty Ltd, 1988- Waikerie Salinity Mitigation Study., South Australia Engineering and Water Supply,

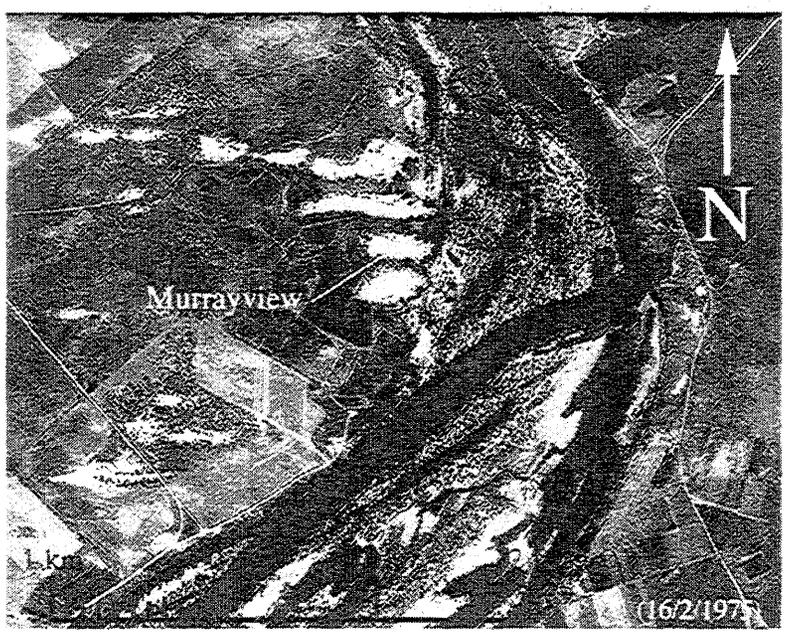
Engineering and Water Supply (E&WS) (South Australia), 1989a- Enhancing wetlands., South Australian River Murray Wetlands Working Party Report, Engineering and Water Supply Department and Department of Environment and Planning, EWS 1439/88, Report no. 88/7, 174 p.

Firman, J.B., 1972- Renmark, South Australia - 1:250 000 Geological Series., Geological Survey of South Australia, Explanatory notes, SI/54-10.

Kernich, A.M., 1984- The climate of the River Murray and environs, South Australia., Technical report, South Australia Department of Agriculture.

South Australia Engineering and Water Supply (E&WS) 1994- Evaluation of Saline Water Disposal Basins along the River Murray between Lock 1 and Lake Victoria, SA Engineering and Water Supply, Draft 94/1

Telfer, A., and Watkins, N., 1991- Waikerie Salt Interception Scheme final design report hydrogeology., South Australia Engineering and Water Supply, EWS 90/14, 51 p.


N
Murrayview
(16/2/197

<Site Name> Noora Basin
<Synonyms>

Spatial

<**Location description**> 20 kilometres east of Loxton, S.A.

<**Located in Murray Trench**> No

<**Location 1:250 000**> Renmark

<**Location 1:100 000**> Renmark 7029

<**Zone**> 54H

<**Coordinates easting (AMG)**> 482000

<**Coordinates northing (AMG)**> 6193500

<**State**> South Australia

General

<**Year begun operation**> 1982

<**Active/inactive**> Active

<**Full surface area (ha)**> 4000 Ha possible, current 500 Ha; 1700 ha at 18.7 m AHD

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> 18.53 m

<**Groundwater level (m AHD)**> 16.7-17.3 m in 1982, 17.5 m in 1988

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> 2100 mm for pan, 1700 mm for free lake surface

<**Volume disposed annually (ML/yr)**> from Berri 1464 to 2226 ML/yr (84-87), from Dishers Creek 1340-4860 ML/yr (84-87)

<**Salinity of water disposed (EC)**> 18,400 EC at inlet

<**Range of salinity in basin (EC)**> 15,000-20,000 EC

<**Regional salinity (EC)**> 48,000 to 84,000 EC

<**Sources of water to be disposed**> Irrigation drainage water pumped from Disher Creek and Berri Basin and groundwater pumped from Renmark Reservoir

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<Site Name> Noora Basin
<Synonyms>

<**Review of environmental impacts**> Increase of high pH and sodium carbonate contamination of soils around Noora affects vegetation and limits future vegetation options. The mallee vegetation on the highland around and within the basin area was cleared early this century for dryland cereal farming giving the landscape a stark denuded appearance. Since the establishment of the basin the impounded water has attracted a large number of bird species and members of Loxton Region of the South Australian Field and Game Association have successfully revegetated the perimeter of the northwest corner of the basin (K. Smith, pers. comm.).

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> SA Engineering and Water Supply

<**Project name**> Noora Disposal Basin

<**Natural, modified natural or constructed**> natural salina

<**Modification type and degree**> Inlet pipe and weir installed in NW end

Geological

<**Site description and Geomorphology**> Boinka, NW-SE oriented complex controlled by the underlying Parilla morphology and structure. The depression in which the boinka lies extends to the Murray River Cliffs, and is defined by ridges of Pliocene Sand. The region consists of samphire-covered saline flats and mounds of gypsiferous quartz sand surmounted by ridges of gypsiferous sediment. No Woorinen linear dunes stranded amidst saline flats.

<**Subsurface investigations at site**> 83 borehole logs, pits

<**Structural setting**> The basin is located northeast of Pinnaroo Block and northwest of Sunset Strip (Macumber, 1980).

<**Stratigraphic setting**> The basin is floored by the Yamba Formation (3 m), and underlain by the Parilla-Loxton Sand (30 m), the Bookpurnong Beds/Winnambool Formation (40 m), the Murray Group Limestone (110 m), and the Renmark Group (200 m). The Blanchetown Clay and the Bungunnia Limestone (20 m), are absent beneath the basin but present around the basin, and the basin is surrounded by Woorinen Formation (15 m) (Geology interpreted from Barnett, 1992).

<**Host formation**> Yamba Formation

<**Host lithofacies**> Two facies 1. Lacustrine; grey clay with crystalline gypsum mud under sulphide rich mud. 2. Aeolian; gypsiferous quartz sand with intercalated gypsiferous palaeosols and millet seed gypsum deposits, which is sometimes altered to copi

<**Aquitard**> Bookpurnong Beds/Winnambool Formation

<**Aquitard lithofacies**> Bookpurnong Beds/ Winnambool Formation: grey green sandy lay, grey green to black clay stone, calcarenite and carbonate sand, limestone, and silty clay (Watkins, 1991)

<**Aquifer**> Parilla Sand and Murray Group Limestone

<**Aquifer lithofacies**> Parilla Sand: Weakly cemented, yellow, bimodal, well sorted and well rounded, with fine sand dominant in ridge crests. Strandplain-Shallow marine environment.

<**Comments**> The Blanchetown Clay is absent in areas of disposal of irrigation tailwaters. Vertical leakage through the Yamba Formation to the Parilla. Lateral leakage through the Woorinen to the

<Site Name> Noora Basin
<Synonyms>

Parilla. Different hydraulic conductivity appears not to have influenced the behaviour of the groundwater mound or regional groundwaters.

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 19 kilometres

<**Head between basin and river/tributary**> 7 metres

<**Direction of groundwater flow in regional aquifer**> Northwest at 0.10 m/kilometres gradient

<**kv of artificial floor**> N/A

<**kv and kh of host**>

<**kv and kh of aquitard**> Bookpurnong Beds: Kv = 0.013 to 1.81 x 10^{-6} m/day; Winnambool Formation: Kv = 1.07 x 10^{-4} m/day (Watkins, 1991)

<**Thickness of aquitard**> Bookpurnong Beds/Winnambool Formation: 40-45 metres

<**kv and kh of aquifer**> Parilla Sand: Transmissivity = 2 x 10^{4} m^2/day , which gives a conductivity: 500 m/day if thickness is 40 metres (Williams et. al, 1989) Very high conductivity, more likely 5-10 m/day; Murray Group Limestone: Kh = 0.117 to 0.199 m/day (Watkins, 1991)

<**EC of aquifer**> Parilla Sand: 48,000 to 84,000 EC

<**Porosity of aquifer**>

<**Thickness of aquifer**> Parilla Sand: 40 metres; Murray Group Limestone: 110 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**> Slopes NNW to SSE (18.28) to (16.28) AHD

Interpretive 1

<**Hydraulic linkage to regional aquifer**> Because the Blanchetown Clay is absent beneath the basin disposal water is able to directly enter the Parilla Sand forming a "freshwater" lens and forcing the watertable in the immediate area (300 km^2) up by 0.6 meters. The amount of water available to enter the Parilla Sand is controlled by the permeability of the Yamba Formation (low) and the rate of evaporation (high) which combine to concentrate disposal water and thus lessen the impact on the surrounding region. The groundwater mound is confined to the Parilla Sand (although it can and will move laterally, eventually to the river) because of the Bookpurnong Beds/Winnambool Formation which is the regional aquitard and because of the upward pressure within the Murray Group Limestone (Watkins, 1991)

<**Hydraulic linkage to surface runoff**> There is a rapid hydrographic response to precipitation even at depth.

<**Category - hydraulic stability**> In the long term, raised water tables, will lead to evaporative concentration in low lying regions and increased salinisation of the Parilla Sand. Eventually the highly saline Parilla water will contaminate the Murray River leading to salt load problems (Chambers et. al, 1992)

<**Category - degree of hydraulic isolation**> Approaching steady state now (Williams et. al, 1989), also consultant report estimating steady state in 300 years (Kinnaird, Hill, DeRohan, and Young, Pty. Ltd., 1979)

<Site Name> Noora Basin
<Synonyms>

<Evaporation surplus>
120 mm (Kinnaird, Hill, DeRohan, and Young, Pty. Ltd., 1979) (2040 ML/yr at 1700 ha)
1400 mm (Williams, et. al, 1988) (23,800 ML/yr at 1700 ha)
600 mm (Williams, et. al, 1988)-probable (10,200 ML/yr for 1700 ha)

Interpretive 2

<Ranking of sustainability>

References Cited

Barnett, S.R., 1992- Regional hydrogeology of the Loxton-Noora area, Murray basin, South Australia., South Australia Department of Mines and Energy, Geological Survey, Report Book 92/15, 6 p.

Chambers, L.A., Williams, B.G., Barnes, C.J., and Wasson, R.J., 1992- The effect of irrigation waste-water disposal in a former discharge zone of the Murray Basin, Australia, Journal of Hydrology, v. 136, p. 303-332

Engineering and Water Supply Department (E&WS) (South Australia), 1989d- Noora Drainage Disposal Scheme: Noora Basin Groundwater Observations, Annual Report No. 7., EWS 89/19, 3 p.

Engineering and Water Supply Department (E&WS) (South Australia), 1988- Noora Drainage Disposal Scheme: Noora Basin Groundwater Observations, Annual Report No. 6., EWS 88/40, 3 p.

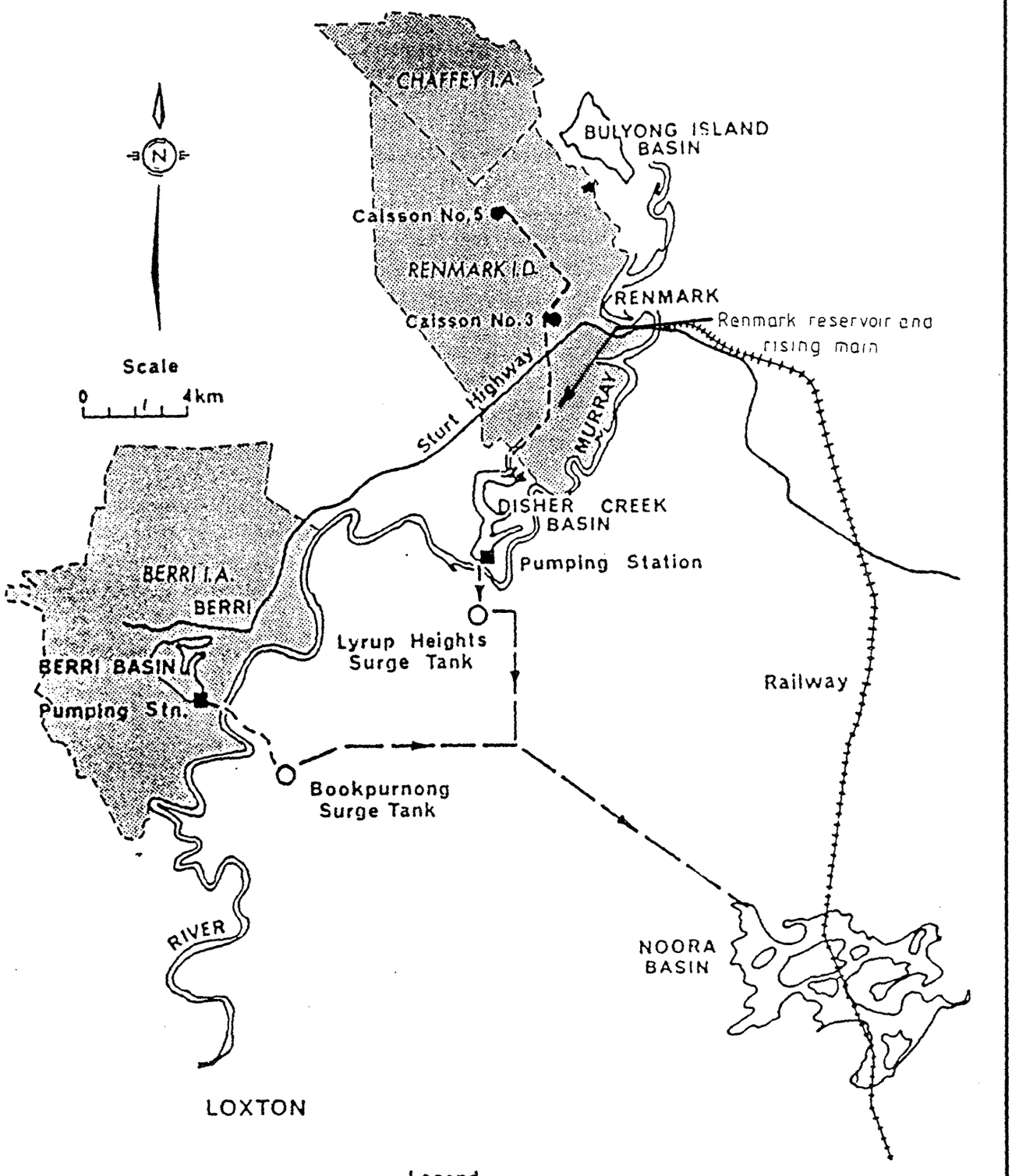
Kinnaird, Hill, DeRohan, and Young, Pty. Ltd., 1979- Salt disposal at Noora. A Report to the South Australian Engineering and Water Supply Department (unpbl.). 173 pp.

Little B.J., 1982- River Murray salinity control programme, Noora drainage disposal scheme, Bulyong Island Basin, rising main investigation., South Australia Engineering and Water Supply Department 1982-09, 22 p.

Watkins, N., 1991- Loxton Salinity Mitigation Studies Noora Drainage Disposal Basin regional impact studies: results of a drilling and pump testing programme March-August 1991., South Australia Engineering and Water Supply Department., EWS 91/24, 5 p.

Williams, B.G., Plumb, L.A., Barnes, C.J., and Wasson, R.J., 1989- Noora Seepage Basin: Saline water disposal, CSIRO Division of Water Resources

Noora Evaporation Basin



(EW&S, 1989d)

<Site Name> Ramco Lagoon
<Synonyms>

Spatial

<**Location description**> 6 kilometres WNW of Waikerie, SA, bounded on the west by the Sunlands Irrigation Area, south by the Golden Heights Irrigation Area, and on the northeast by the Murray River (Woodcutters Reach).

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Renmark

<**Location 1:100 000**> Morgan 6829

<**Zone**> 54H

<**Coordinates easting (AMG)**> 400500

<**Coordinates northing (AMG)**> 6219000

<**State**> South Australia

General

<**Year begun operation**> late 1920's

<**Active/inactive**> Active

<**Full surface area (ha)**> 90 ha; 87 ha at 6.1 m AHD

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> 6.1 m AHD

<**Groundwater level (m AHD)**> 8-10 m AHD (Barnett, 1991)

<**Groundwater seepage/discharge**> Discharge

<**Average annual evaporation**> Regional: 2250 mm/yr (Kernich, 1984); Local: 1600-1700 mm/yr

<**Volume disposed annually (ML/yr)**> 12 ML/yr

<**Salinity of water disposed (EC)**> 5010-6230 EC (1986); 7180 EC (Feb 1990)

<**Range of salinity in basin (EC)**> 820-26,300 EC; 7960 EC (Feb. 1990)

<**Sources of water to be disposed**> Tile drainage water from Ramco Division of the Waikerie Irrigation Area.

<**Terminal/throughflow basin**> Partial flushing capacity during high flows; Originally ARI of floods 1:2, but earthworks during 1990/91 have improved flushing frequency to 1:5 (K. Smith, pers. comm.)

<**Range of elevation of lake surface with disposal**> 6.06-6.77 m AHD

<**Lining/treatment of base**> None

<**Review of environmental impacts**> The area is heavily used by campers and picnickers resulting in degradation of the vegetation. In addition, Sunlands Irrigators take water downstream from Ramco Lagoon so full flushing of saline water would affect them (EWS, 1989a).

<Site Name> Ramco Lagoon
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> SA Engineering and Water Supply

<**Project name**> Ramco Lagoon

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> 1 inlet/outlet with a regulator

Geological

<**Site description and Geomorphology**> Ramco Lagoon is a stranded meander of the Murray River. It has a typical complex of banks and channels with river red gums, reeds, river cooba, lignum, and river box (EWS, 1989a).

<**Subsurface investigations at site**> Twelve piezometers or bores around basin perimeter

<**Structural setting**> In Murray Trench west of the Morgan Fault and east of the Encounter Fault Zone (Firman, 1972).

<**Stratigraphic setting**> The basin is floored by the Coonambidgal Formation (3 m), and is underlain by the Monoman Formation (10-15 m), the Cadell Marl (1.5 m), the Upper Murray Group Limestone (10-15 m), the Finnis Clay (0-4 m), the Lower Murray Group Limestone (110 m), the Ettrick Clay, the Renmark Group (40 m) (Coffey, 1988; and EWS bore logs, unpublished).

<**Host formation**> Coonambidgal Formation

<**Host lithofacies**> Clays and silts

<**Aquitard**> Coonambidgal Formation, Cadell Marl, and Finnis Clay

<**Aquitard lithofacies**> Coonambidgal Formation: Grey clay, black silty clay, and puggy silt; Cadell Marl: calcareous clay; Finnis Clay: Marls, marly limestone, and bryozoal remains (Coffey, 1988)

<**Aquifer**> Monoman Formation and Upper Murray Group Limestone

<**Aquifer lithofacies**> Monoman Formation: Medium to coarse quartz sand; Upper Murray Group Limestone: calcarenite

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> On floodplain

<**Head between basin and river/tributary**>

<**Direction of groundwater flow in regional aquifer**> North to the Murray River (Barnett, 1991)

<Site Name> Ramco Lagoon
<Synonyms>

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard> Cadell Marl: Kv = 2 x 10^{-4} m/d ; Finnis Clay: Kv = 3 x 10^{-3} m/d (Telfer and Watkins, 1991)

<Thickness of aquitard> Coonambidgal Formation: 3 metres; Cadell Marl: 1.5 metres; Finnis Clay: 0-4 metres

<kv and kh of aquifer> Murray Group Limestone: Kv = 1.5 to 2.25 m/day, Kh = 0.15 to 1.08 m/day; Renmark Group: Kh = 1.8 m/day (Coffey, 1988); Upper Murray Group Limestone: Transmissivity = 250 m^2/d (Telfer and Watkins, 1991)

<EC of aquifer> Murray Group Limestone: 1385-29,600 EC depending on proximity to irrigation recharge, Monoman Formation: 36,000 EC (Coffey, 1988); Upper Murray Group Limestone: 10,000-20,000 mg/L (generally lower salinities prevail due to flushing from the irrigation areas), Lower Murray Group Limestone: 28,800 mg/L (less irrigation effects due to 'protection' by the Finnis Clay, the exception is at Waikerie Bend, where a long history of irrigation has lowered the salinities to less than 10,000 mg/L) (Telfer and Watkins, 1991).

<Porosity of aquifer>

<Thickness of aquifer> Monoman Formation: 10-15 metres; Upper Murray Group Limestone: 10 metres; Lower Murray Group Limestone: 110 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Total groundwater accession due to irrigation is 24.4 ML/day, which is divided as follows: Tile drains to Ramco and Hart Lagoons = 1 ML/day, Cliff seepage = 0.2 ML/day, Growth in Norwest Bend Formation mound = 3 ML/day, Evaporation = 0.2 ML/day, and recharge into the Murray Group Limestone = 20 ML/day. This has formed a large groundwater mound in both the Norwest Bend Formation and the Murray Group Limestone resulting in a change of the pattern of flow within the aquifer. Flow has increased into the river with the relatively fresh (800-2200 EC) irrigation disposal water displacing the high salinity (19,000+ EC) into the Murray River. The Renmark Group also contributes saline water into the Murray Group (and thus the Murray River) because of its high hydraulic head (30 m AHD). The evaporation basin itself provides little recharge because it is kept below or at the level of the river (Coffey, 1988).

Salt balance equations form Ramco Lagoon indicate that it receives 33 t/d of salt. However through the tile drains it receives only 5 t/d. The missing salt must be derived from either the Lower Murray Group Limestone or from moderate salinity water from the Monoman Formation pushed by the irrigation mound (Telfer and Watkins, 1991). It is also possible that the salt may be carried by direct seepage and discharge from the regional aquifer caused by the Sunlands Irrigation Area groundwater mound to the west (unquantified) (S. Barnett, pers. comm.).

<Hydraulic linkage to surface runoff> The salinity in the Monoman Formation is higher between Ramco Lagoon and the River Murray than it is away from the lagoon. This is because the lagoon intercepts the irrigation disposal water and stops it from reaching the river. The high salinity (26,600 mg/L) in the Monoman Formation is the result of upward leakage from the Lower Murray Group Limestone. Where there is no lagoon the irrigation disposal water mixes and dilutes the high salinity water. Therefore it must be assumed that Ramco lagoon fulfils its purpose. However, a long term solution to the problem will require interception of the Lower Murray Group Limestone water and disposal to another site (Stockyard Plain?) (Telfer and Watkins, 1991).

<Site Name> Ramco Lagoon
<Synonyms>

<**Category - hydraulic stability**> Ramco Lagoon causes few problems because it is kept at or below the level of the river. The large groundwater mound beneath the Waikerie Irrigation Area is pushing high salinity water into the Murray River, however this is being mitigated by the Waikerie SIS. Work is currently under way to address the salt load directly to Ramco Lagoon due to upward leakage and direct seepage from the western cliffs which is mobilised by Sunlands Irrigation Area (S. Barnett, pers. comm.).

<**Category - degree of hydraulic isolation**>

<**Evaporation surplus**>

Interpretive 2

<**Ranking of sustainability**>

References Cited

Barnett, S.R. (South Australia Department of Mines and Energy), 1991- Renmark Hydrogeologic Map (1:250 000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia

Coffey and Partners Pty Ltd, 1988- Waikerie Salinity Mitigation Study., South Australia Engineering and Water Supply,

Engineering and Water Supply (E&WS) (South Australia), 1989a- Enhancing wetlands., South Australian River Murray Wetlands Working Party Report, Engineering and Water Supply Department and Department of Environment and Planning, EWS 1439/88, Report no. 88/7, 174 p.

Firman, J.B., 1972- Renmark, South Australia - 1:250 000 Geological Series., Geological Survey of South Australia, Explanatory notes, SI/54-10.

Kernich, A.M., 1984- The climate of the River Murray and environs, South Australia., Technical report, South Australia Department of Agriculture.

Telfer, A., and Watkins, N., 1991- Waikerie Salt Interception Scheme final design report hydrogeology., South Australia Engineering and Water Supply, EWS 90/14, 51 p.

<Site Name> Renmark Reservoir
<Synonyms> Bookmark Creek

Spatial

<**Location description**> Forms western flank of Renmark township, 2.5 kilometres west of P.O.

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Renmark

<**Location 1:100 000**> Renmark 7029

<**Zone**> 54H

<**Coordinates easting (AMG)**> 475500

<**Coordinates northing (AMG)**> 6215500

<**State**> South Australia

General

<**Year begun operation**> 1895 to 1960's - Water supply system; 1960's used as a salinity control; in 1979 disposal water started to be pumped to Disher Creek (and from Disher Creek to Noora).

<**Active/inactive**> Active

<**Full surface area (ha)**> 19.7 ha; operationally 14 ha at 14.2 m AHD

<**Volume capacity (ML)**> 239 ML; 135 ML at 14.2 m AHD

<**Full surface level (m AHD)**> 14.8 m AHD; 14.2 m AHD (K. Smith, pers. comm.)

<**Groundwater level (m AHD)**> 15 m AHD

<**Groundwater seepage/discharge**> Discharge from irrigation mound on both sides of the basin

<**Average annual evaporation**> 1600-17000 mm/yr (K. Smith, pers. comm.)

<**Volume disposed annually (ML/yr)**> 4174 ML/yr (1991-92); 328 ML/yr average (1987-92)

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**> 1480 EC (8/93) to 29,100 (4/92); maximum salinity 50,700 EC (Micke, 1994)

<**Sources of water to be disposed**> Saline groundwater from irrigation mound and surface water course control

<**Terminal/throughflow basin**> Throughflow (pumped to Disher Creek) and flushing capability ARI of floods 1:2

<**Range of elevation of lake surface with disposal**> 14.2 - 16.8 m AHD

<**Lining/treatment of base**>

<**Review of environmental impacts**> The area adjacent to the channel, downstream of the inlet structure, is badly salinised and degraded but there has been some significant improvement in the health of the vegetation adjacent to the downstream section of the complex where the groundwater inflow from the irrigation mound has displaced the more saline groundwater.

<Site Name> Renmark Reservoir
<**Synonyms**> Bookmark Creek

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> SA Engineering and Water Supply

<**Project name**> Renmark Reservoir

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> 1 inlet and 2 outlet, flushing spillways

Geological

<**Site description and Geomorphology**> Bookmark Creek is an isolated stream channel of the Murray River that has been dammed off to provide a reservoir.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located east of the Renmark Trough and within the Paringa Embayment (Firman, 1972).

<**Stratigraphic setting**> The basin is floored by the Coonambidgal Formation (5 m), and is underlain by the Monoman Formation (20-30 m), the Parilla Sand (20 m), the Bookpurnong Beds (20 m), the Murray Group Limestone (110 m), and the Renmark Group (200 m) (Geology interpreted from Firman, 1972).

<**Host formation**> Coonambidgal Formation

<**Host lithofacies**> Clays and silts

<**Aquitard**> Coonambidgal Formation and Bookpurnong Beds

<**Aquitard lithofacies**> Coonambidgal Formation: Grey clays, silts, and sand; Bookpurnong Beds: Grey brown shelly silts and clays

<**Aquifer**> Parilla Sand and Monoman Formation

<**Aquifer lithofacies**> Parilla Sand and Monoman Formation: Medium to coarse quartz sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 1 kilometre

<Site Name> Renmark Reservoir
<**Synonyms**> Bookmark Creek

<**Head between basin and river/tributary**> < 1 metre

<**Direction of groundwater flow in regional aquifer**> Southwest towards the river (Barnett, 1991)

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**> Bookpurnong Beds: 10^{-3} to 10^{-6} m/day (Barnett, 1992)

<**Thickness of aquitard**> Coonambidgal Formation: 5 metres; Bookpurnong Beds: 20-30 metres

<**kv and kh of aquifer**> Monoman Formation: 10-20 m/d

<**EC of aquifer**> Parilla Sand: 35,000 to 100,000 mg/L (Barnett, 1991)

<**Porosity of aquifer**>

<**Thickness of aquifer**> Monoman Formation: 20-30 metres; Parilla Sand: 30 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> The Murray Group Limestone is under artesian pressure underneath the floodplain and the Parilla Sand is under pressure due to the irrigation mound (18 m AHD) under the Renmark Irrigation Area. Basin salinity is controlled by frequency of flushing by the river and the influx from the groundwater mound in the Parilla Sand. A high flushing frequency means low salinities, while a low flushing frequency results in high salinities due to evaporation and groundwater influx.

<**Hydraulic linkage to surface runoff**> Connected to the river by an outlet

<**Category - hydraulic stability**>

<**Category - degree of hydraulic isolation**>

<Site Name> Renmark Reservoir
<Synonyms> Bookmark Creek

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

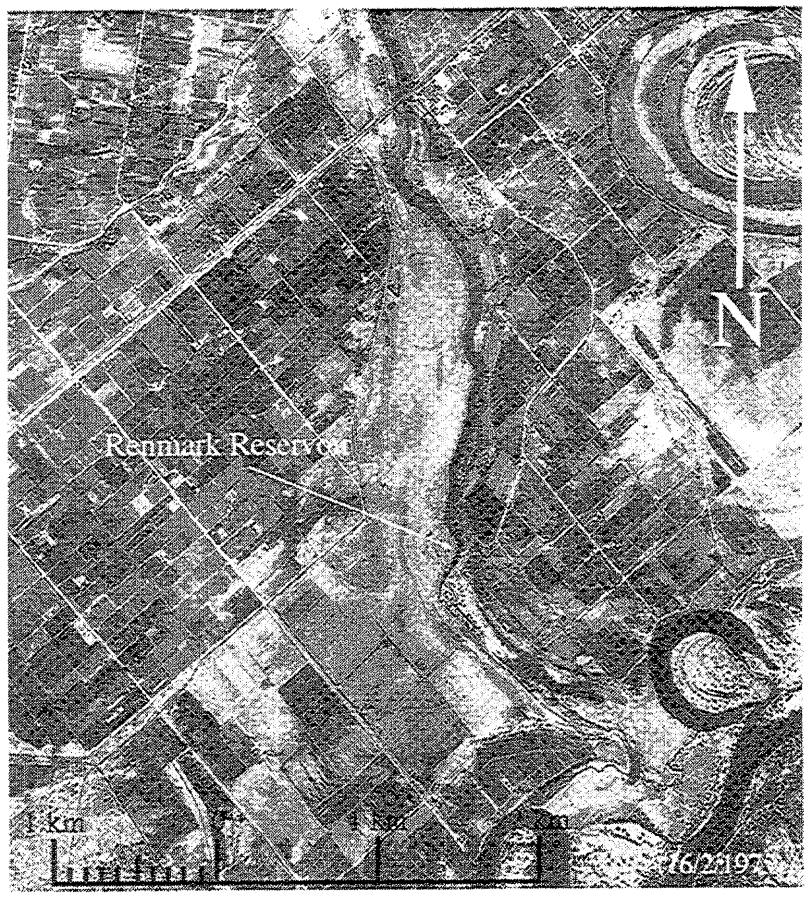
References Cited

Barnett, S.R., 1992- Regional hydrogeology of the Loxton-Noora area, Murray basin, South Australia., South Australia Department of Mines and Energy, Geological Survey, Report Book 92/15, 6 p

Barnett, S.R. (South Australia Department of Mines and Energy), 1991- Renmark Hydrogeologic Map (1:250 000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia

Firman, J.B., 1972- Renmark, South Australia - 1:250 000 Geological Series., Geological Survey of South Australia, Explanatory notes, SI/54-10.

Micke, S., 1994- Renmark Reservoir Salinity Control Scheme Operational Performance Review, SA Engineering and Water Supply, Unpublished


N
Renniark Reservoir
1 km
1 km
1 km

<Site Name> Rufus River Disposal Basin
<Synonyms>

Spatial

<**Location description**> 3 to 6 kilometres WNW of Rufus River Settlement on an arid plateau west of Lake Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Lindsay 7129

<**Zone**> 54H

<**Coordinates easting (AMG)**> 520000

<**Coordinates northing (AMG)**> 6236000

<**State**> New South Wales

General

<**Year begun operation**> 1984

<**Active/inactive**> Active

<**Full surface area (ha)**> 300 ha at 54.5 m AHD

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> 54.5 m AHD

<**Groundwater level (m AHD)**> 22.7 m AHD

<**Groundwater seepage/discharge**> Estimated 1 L/day/ha seepage

<**Average annual evaporation**> 1400 mm/yr

<**Volume disposed annually (ML/yr)**> up to 9000 ML/yr; average 4500 ML/yr

<**Salinity of water disposed (EC)**> 25,000-30,000 EC

<**Range of salinity in basin (EC)**> 30,800-57,800 EC (7/91)

<**Sources of water to be disposed**> Saline groundwater interception along both sides of Rufus River and along Brilka Creek above its confluence with the Rufus River.

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**> 1 m?

<**Lining/treatment of base**> Walls-packed lay and keyed into underlying Blanchetown Clay

<**Review of environmental impacts**> Isolated from local area by the Blanchetown Clay (perched aquifer)

<Site Name> Rufus River Disposal Basin
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**>South Australia Engineering and Water Supply

<**Project name**> Rufus River Groundwater Interception Scheme

<**Natural, modified natural or constructed**> Constructed

<**Modification type and degree**> Embankments at east and west ends, and clay walls keyed into Blanchetown Clay through the Woorinen Formation.

Geological

<**Site description and Geomorphology**> Complex consists of 5 interconnected basins sitting in partially cleared mallee and saltbush (*Artiplex spp.*). Surficial geology consists of the Woorinen Formation and Mallee soils, although in interdune swales the mallee soils are absent and the Blanchetown clay is exposed (Collingham and Newman, 1982).

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located northeast of the Wentworth Trough and southeast of the Renmark Trough (Barnett, 1991; and RWC, 1991).

<**Stratigraphic setting**> The area is floored by the Woorinen Formation (0-2 metres) which has a high proportion of calcrete and clay. It is underlain by the Blanchetown Clay (18 m), the Parilla Sand (30 m), the Bookpurnong Beds/Winnambool Formation (20 m), the Murray Group Limestone (110 m), and the Renmark Group (200 m) (Collingham and Newman, 1982).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> High proportion of calcareous material (20-50%) and clay (20-30%) (Collingham and Newman, 1982)

<**Aquitard**> Blanchetown Clay

<**Aquitard lithofacies**> Stiff to hard, reddish brown or green mottled clay with thin sand lenses (Collingham and Newman, 1982)

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Medium to coarse quartz sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 1.3 kilometres to Lake Victoria; 2.2 kilometres to the Murray River

<**Head between basin and river/tributary**> 34.5 metres

<**Direction of groundwater flow in regional aquifer**> Southwest

<Site Name> Rufus River Disposal Basin
<Synonyms>

<kv of artificial floor>

<kv and kh of host> Woorinen Formation: Kv = 9 x 10^{-4} m/day; and Kh variable but ranges from 7 m/day to 0.3 m/day (Collingham and Newman, 1982)

<kv and kh of aquitard>

<Thickness of aquitard> Blanchetown Clay: 18 metres

<kv and kh of aquifer> Parilla Sand: Transmissivity = 200 m^2/day

<EC of aquifer> Parilla Sand: 54,000 mg/L

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 30 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The present Lake Victoria was formed in 1928 due to the damming of Frenchman's Creek. Since then, water levels have risen in the surrounding area and are expected to continue to do so for the next four hundred years (Waterhouse, 1989). This has caused a steep groundwater gradient to form and has increased the flow of groundwater entering Rufus River (and the River Murray). The water entering the Rufus River is highly saline and has caused severe degradation of the area and large salt flows to the Murray River, which is why the Rufus River Groundwater Interception Scheme was developed. Groundwater is intercepted before it reaches the river and is pumped to a disposal basin. The basin is isolated from the regional aquifer because of a thick deposit (18 m) of Blanchetown Clay. There may be growth in the perched aquifer within the Woorinen Formation (on top of the Blanchetown Clay), which may raise local groundwater levels and cause salinisation of low lying regions around the basin.

<Hydraulic linkage to surface runoff> None

<Category - hydraulic stability> Some leakage through the Woorinen dunes in the northwest corner (Collingham and Newman, 1982)

<Category - degree of hydraulic isolation>

<Site Name> Rufus River Disposal Basin
<Synonyms>

<Evaporation surplus> 1140 mm/yr (Evaporation = 1400 mm/yr and precipitation = 260 mm/yr) (EWS, 1979)

Interpretive 2

<Ranking of sustainability>

References Cited

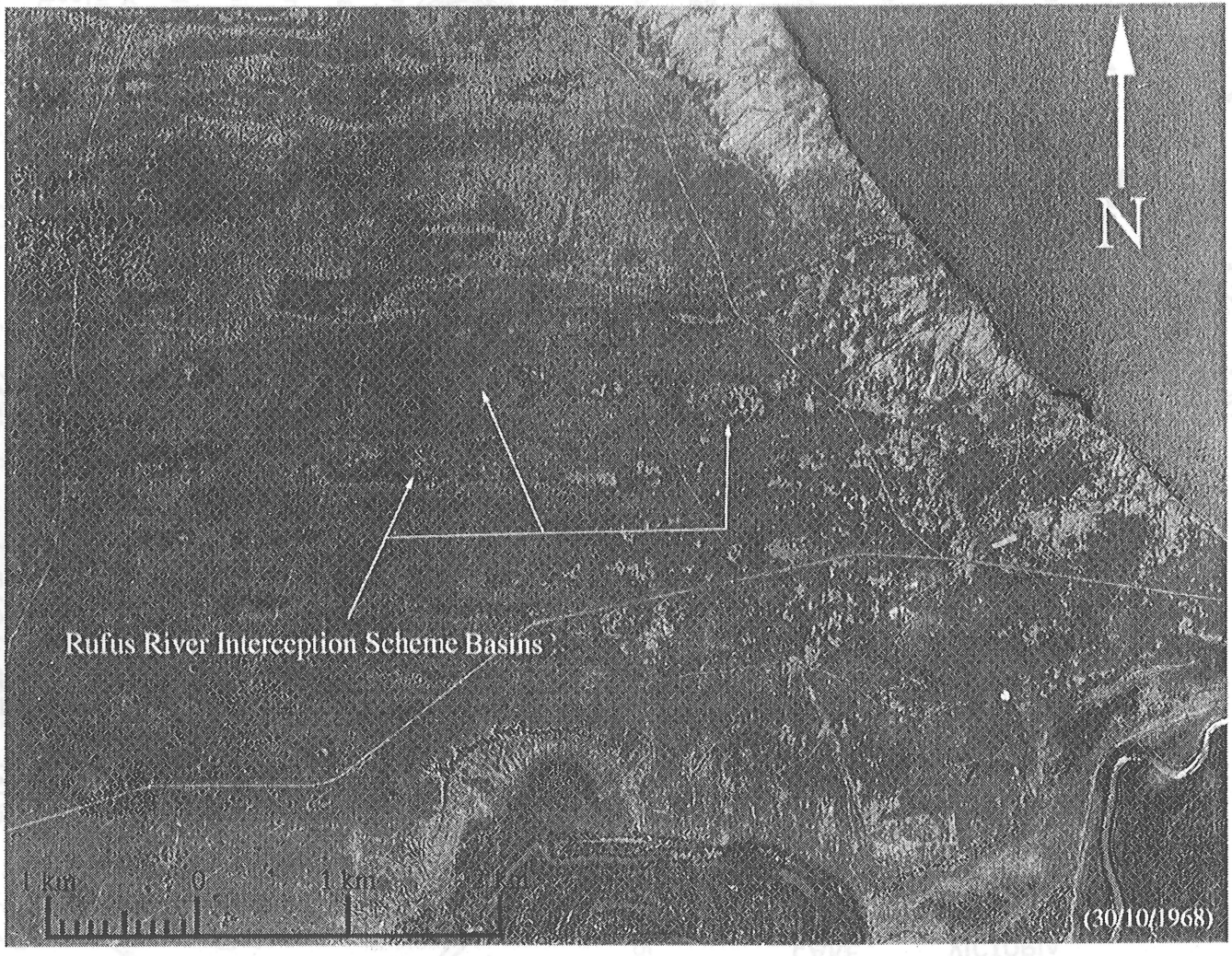
Barnett, S.R. (South Australia Department of Mines and Energy), 1991- Renmark Hydrogeologic Map (1:250 000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia

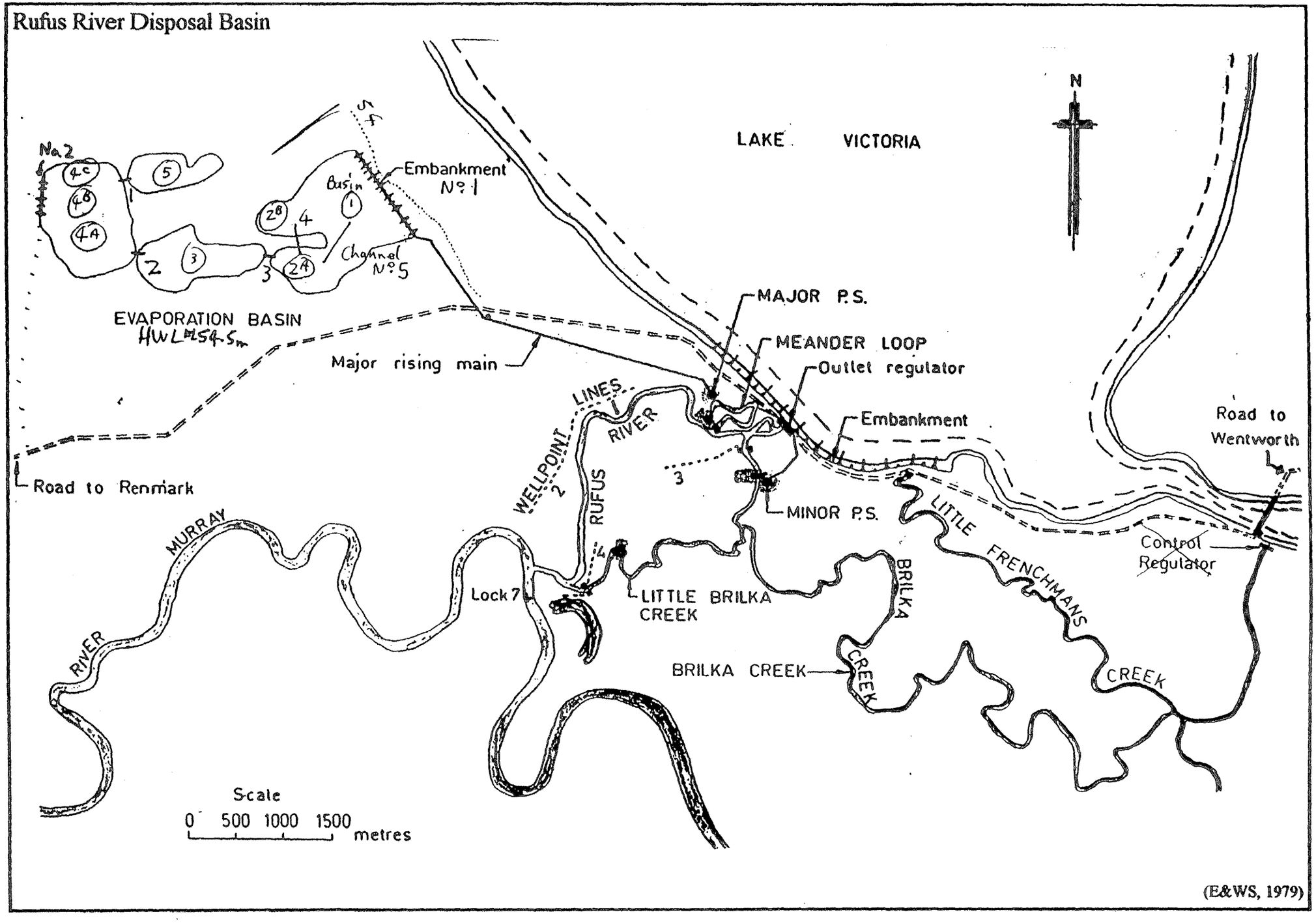
Collingham, E.B., and Newman, R.J., 1982- Rufus River Saline Groundwater Interception Scheme: Proposed Evaporation Basin Site 'A': Soil report and design summary, South Australia Engineering and Water Supply, EWS 82/20, 10 p

Engineering and Water Supply Department (E&WS) (South Australia), 1979- The Rufus River groundwater interception scheme., South Australia Engineering and Water Supply Department Report 79/29, 35 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Waterhouse, J., 1989- Salinity mitigation investigations in South Australia: Chowilla the hydrogeology of the Chowilla Floodplain: Status report., Murray Darling Basin Commission, 15 p.


N
Rufus River Interception Scheme Basins
1 km
0
1 km
2 km
(30/10/1968)


Rufus River Disposal Basin
LAKE VICTORIA
N
Embankment No. 1
Basin 1
Channel No. 5
EVAPORATION BASIN
HWL 54.5m
Major rising main
MAJOR P.S.
MEANDER LOOP
Outlet regulator
Embankment
Road to Renmark
Road to Wentworth
WELLPOINT LINES
RIVER RUFUS
MINOR P.S.
LITTLE FRENCHMANS CREEK
Control Regulator
MURRAY RIVER
Lock 7
LITTLE BRILKA CREEK
BRILKA CREEK
BRILKA CREEK
Scale
0 500 1000 1500 metres
(E&WS, 1979)

<Site Name> Stockyard Plain
<**Synonyms**> Woolpunda Groundwater Interception Scheme

Spatial

<**Location description**> 15 kilometres WSW of Waikerie, SA and 3 kilometres north of Sturt Highway (Waikerie-Blanchetown Road)

<**Located in Murray Trench**> No

<**Location 1:250 000**> Renmark

<**Location 1:100 000**> Morgan 6829

<**Zone**> 54H

<**Coordinates easting (AMG)**> 393000

<**Coordinates northing (AMG)**> 6212000

<**State**> South Australia

General

<**Year begun operation**> 1990

<**Active/inactive**> Active

<**Full surface area (ha)**> 675 ha at 31 m AHD; After one year 60 ha inundated to depth of 5.3 metres (EWS, 1992)

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> 31 m AHD

<**Groundwater level (m AHD)**> 6 m AHD

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> 2200 mm/yr

<**Volume disposed annually (ML/yr)**> 7500 ML/yr

<**Salinity of water disposed (EC)**> 26,400 to 32,800 EC

<**Range of salinity in basin (EC)**> 64,000 mg/L

<**Sources of water to be disposed**> Saline water from Woolpunda Salt Interception Scheme and from Waikerie Salt Interception Scheme

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**> 24.3 to 29.56 m AHD

<**Lining/treatment of base**> None

<**Review of environmental impacts**> The basin may salinise the area around it, and the high salinities within the basin will severely limit the aquatic life that can live there (Kinhill Engineers, 1987a). Presently, the basin attracts a large number of bird species (K. Smith, pers. comm.).

<Site Name> Stockyard Plain
<Synonyms> Woolpunda Groundwater Interception Scheme

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> SA Engineering and Water Supply

<**Project name**> Woolpunda Salt Interception Scheme

<**Natural, modified natural or constructed**>Constructed

<**Modification type and degree**> Channels have been excavated to connect some of the depressions and impoundment banks have been constructed at the easterly and westerly extremities of the basin (K. Smith, pers. comm.).

Geological

<**Site description and Geomorphology**> The basin is located in an area of cleared and semi-cleared mallee with a long history of disturbance. It sits in a complex of interconnected natural depressions and is surrounded by Woorinen Dunes, to which it is also hydraulically connected (Kinhill Engineers, 1987a).

<**Subsurface investigations at site**>

<**Structural setting**> The basin lies west of the Encounter Fault Zone, and east of the Morgan Fault (Firman, 1972).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (10 m), and is underlain by the Norwest Bend Formation (5 m), the Cadell Marl (3-8 m), the Murray Group Limestone (100 m), and the Renmark Group (200 m) (Kinhill Engineers, 1987a).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red brown, aeolian sand and rubbly calcrete (Collingham and Newman, 1986)

<**Aquitard**> Cadell Marl and Clay or gypsum layer (Woorinen or Blanchetown Clay?) (Collingham and Newman, 1986)

<**Aquitard lithofacies**> Cadell Marl: Grey, stiff, very low permeability clay and carbonate fines alternating with grey, strongly cemented, low permeability, carbonate fines; Clay and gypsum layer: grey, green, or brownish, firm to stiff, clay with gypsum, and layers of pure gypsum (high permeability) (Collingham and Newman, 1986)

<**Aquifer**> Norwest Bend Formation (Parilla Sand equivalent), and Murray Group Limestone

<**Aquifer lithofacies**> Norwest Bend Formation: Yellow to orange brown, uncemented, fine to medium to coarse quartz sand, and strongly cemented oyster beds; Murray Group Limestone: Grey, weakly cemented, fine carbonate sand (Collingham and Newman, 1986)

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 10.5 kilometres SW of Murray River, 17.5 kilometres east of

<Site Name> Stockyard Plain
<Synonyms> Woolpunda Groundwater Interception Scheme

the Murray River

<**Head between basin and river/tributary**> 27-28 metres

<**Direction of groundwater flow in regional aquifer**> Westerly

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**> Cadell Marl: Kv = 1 x 10^{-8} to 5 x 10^{-9} m/s (9 x 10^{-4} to 4 x 10^{-4} m/d)

<**Thickness of aquitard**> Cadell Marl: 3-8 metres; Clay and gypsum layer: 0-5 metres

<**kv and kh of aquifer**> Murray Group Limestone: Kh = 1.5-2.3 m/d (Telfer, 1987); Norwest Bend: Kh = 2 to 50 m/day (Collingham, 1986)

<**EC of aquifer**> Murray Group Limestone: 22,000 mg/L

<**Porosity of aquifer**>

<**Thickness of aquifer**> Murray Group Limestone: 100 metres; Norwest Bend Formation: 6-10 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**> Before disposal surface sloped gently to the west and was at an elevation of 5-6 m AHD (Kinhill Engineers, 1987a).

Interpretive 1

<**Hydraulic linkage to regional aquifer**> Stockyard Plain Basin was designed to leak at a rate of approximately 70% of inflow or 120 L/second. The water forms a perched aquifer within the Woorinen Formation and the Norwest Bend Formation and also penetrates the Cadell Marl into the Murray Group Limestone. The perched aquifer has spread laterally (600 metres) causing surface salinisation and will continue to spread until it reaches a steady state between inflow and penetration to the Murray Group Limestone. The mound in the Murray Group will continue to grow as long as the basin is operational with the first effects reaching the Murray River in about 100 years. This will cause an increase of 6 tonnes/day of salt into the Murray River and will continue to affect the river for a further 10,000 years when the solute peak will reach the river (Kinhill Engineers, 1987a).

<**Hydraulic linkage to surface runoff**> There is no link to surface drainage

<**Category - hydraulic stability**> If operated continuously, the basin will cease its benefit in about 10,000 years. However, the effect would then linger for another 10,000 years (Kinhill Engineers, 1987a)

<**Category - degree of hydraulic isolation**> It will take 100 years for the first pulse of salinity to

reach the River Murray (Kinhill Engineers, 1987a)

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Collingham, E.B., and Newman, R.J., 1986- Woolpunda Groundwater Interception Scheme: Geotechnical report for disposal to a basin at site Y, South Australia Engineering and Water Supply, EWS 86/55.

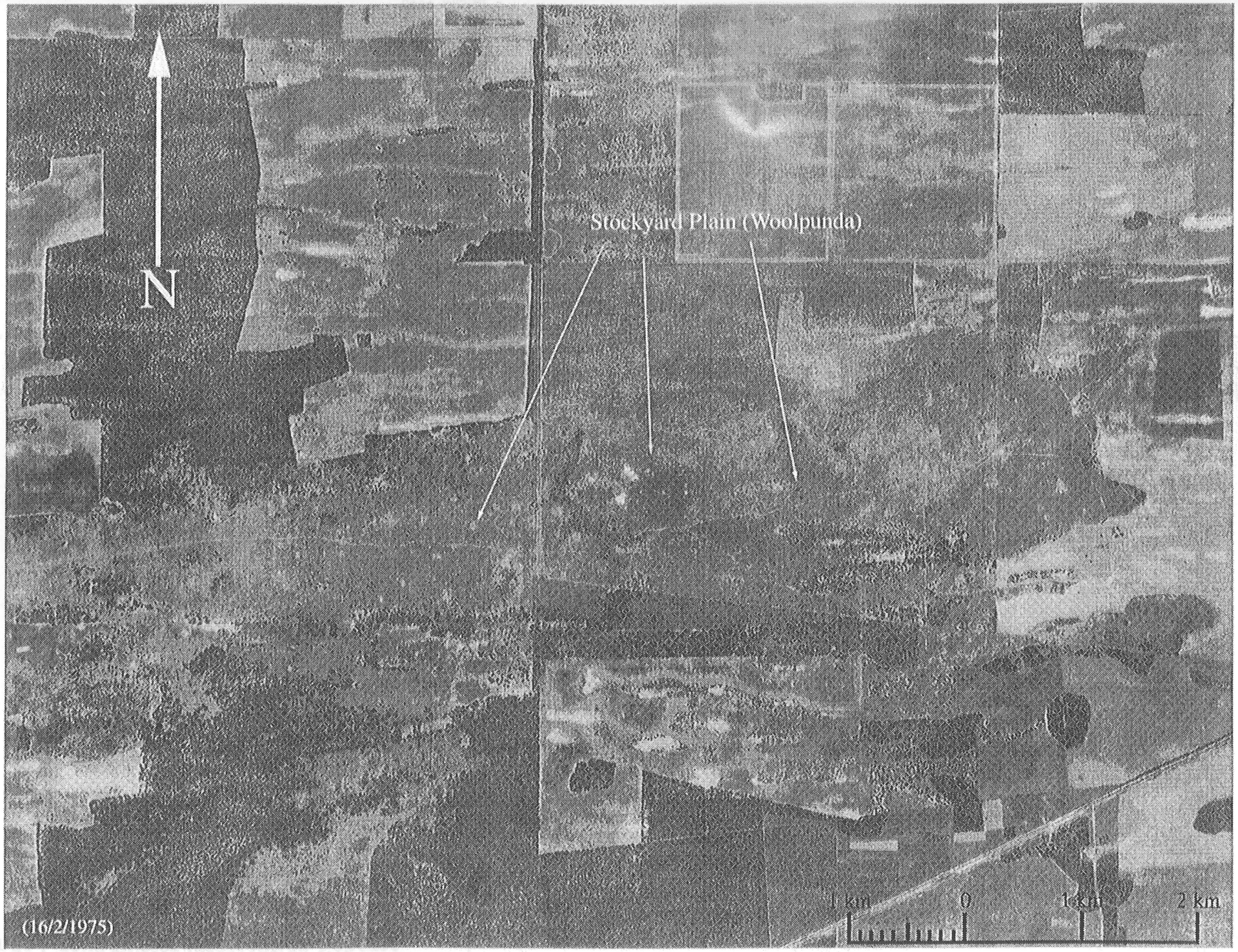
Engineering and Water Supply Department (E&WS) (South Australia), 1992- Woolpunda Salt Interception Scheme report no. 1, July 1990-June 1991, EWS 91/25

Firman, J.B., 1972- Renmark, South Australia - 1:250 000 Geological Series., Geological Survey of South Australia, Explanatory notes, SI/54-10.

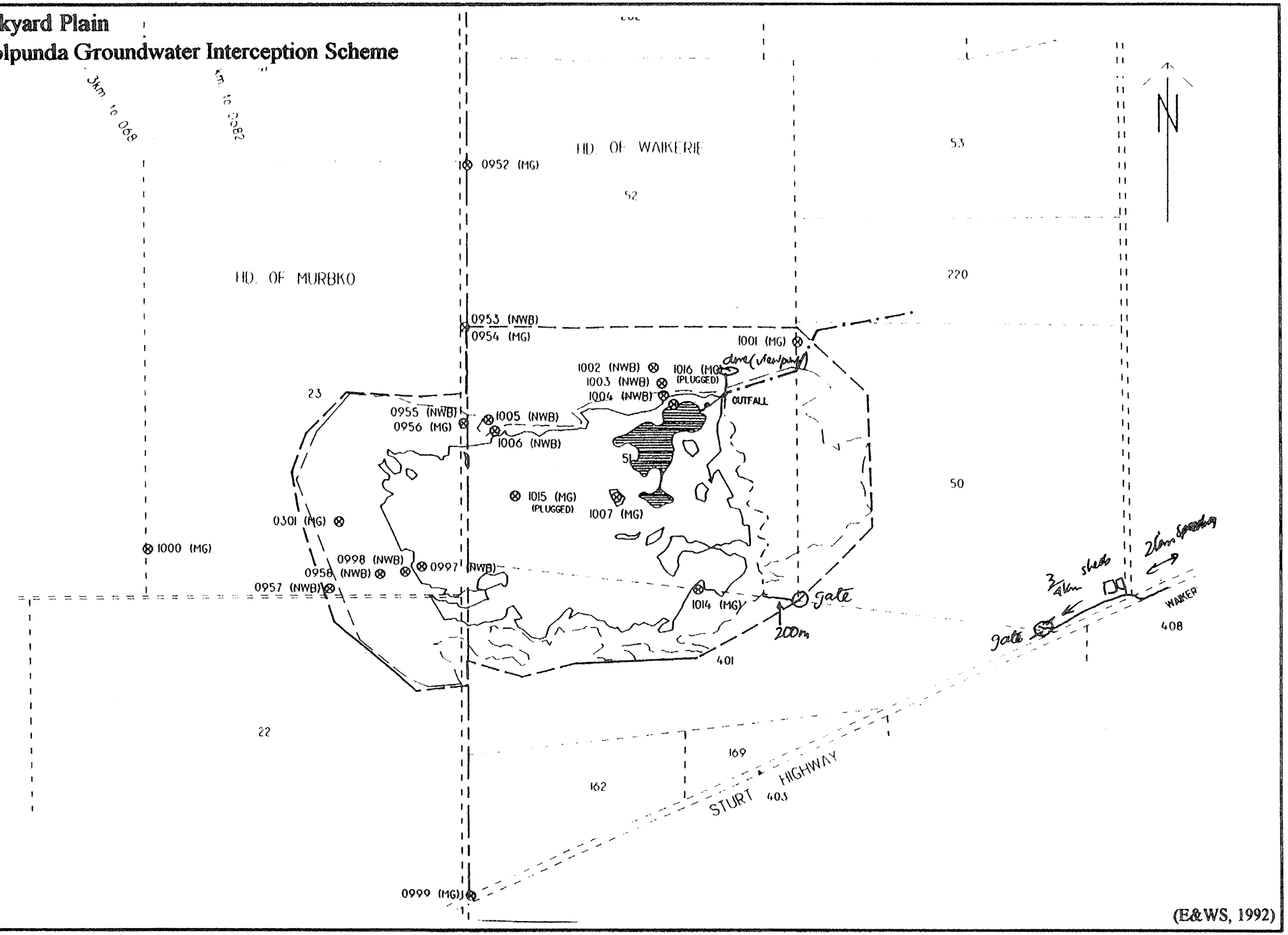
Kinhill Engineers, 1987a- Woolpunda groundwater interception scheme: draft environmental impact statement., South Australia Engineering and Water Supply Department., 60 p.

Kinhill Engineers, 1987b- Woolpunda groundwater interception scheme: supplement to the draft environmental impact statement., South Australia Engineering and Water Supply Department, 1987-11

Telfer, A., 1987- Executive summary: Hydrogeology Woolpunda Groundwater Interception Scheme: Preconstruction investigation and design volume III, South Australia Engineering and Water Supply, EWS 87/42, 34 p


N
Stockyard Plain (Woolpunda)
1 km
0
1 km
2 km
(16/2/1975)

Stockyard Plain
Woolpunda Groundwater Interception Scheme



(E&WS, 1992)

New South Wales

<Site Name> Fletcher's Lake
<Synonyms>

Spatial

<**Location description**> 5 kilometres north of Dareton, NSW

<**Located in Murray Trench**> No, but high flood connection to the Murray River via Tuckers Creek

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 595000

<**Coordinates northing (AMG)**> 6234000

<**State**> New South Wales

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 840 ha

<**Volume capacity (ML)**> 550 ML in 1989 depth 10-13 cm

<**Full surface level (m AHD)**> 29.2 m AHD

<**Groundwater level (m AHD)**> 32.5 m AHD in the Parilla Sand and 30 m AHD overall (Van der Lelij and Erny, 1989)

<**Groundwater seepage/discharge**> Discharge, 1 metre head difference

<**Average annual evaporation**> 1990 ML, 50 ML enters the Murray River with a salinity of 975 mg/L (Williams and Erny, 1991)

<**Volume disposed annually (ML/yr)**> 1100 ML/yr (Williams and Erny, 1991)

<**Salinity of water disposed (EC)**> 325-1200 mg/L TDS; average 515 mg/L TDS (Williams, 1993); 500 ML disposed direct to Fletchers lake at 800 mg/L; 600 ML from Tuckers Creek at 1950 mg/L (Williams and Erny, 1991).

<**Range of salinity in basin (EC)**> 36,400 mg/L TDS (Williams, 1993); Range of salinities in the basin 165,800 EC in the southeast, 74,000 EC in the southwest, and 56,700 EC in the north of the basin (Williams and Erny, 1991)

<**Sources of water to be disposed**> Irrigation excess (Coomealla Irrigation Area) and disposal from Tuckers Creek into Fletchers Lake.

<**Terminal/throughflow basin**> Terminal although there is partial flushing during floods from Tuckers Creek: ARI of floods 1:100

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<Site Name> Fletcher's Lake
<Synonyms>

<Review of environmental impacts>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> New South Wales Department of Water Resources

<**Project name**> Coomealla Irrigation District

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is roughly oval shaped and trends N-S. The eastern margin has a large lunette (20-30 metres), as well as a complex of deflation/lunettes towards the east. The surrounding region is covered in mallee scrubland saltbush (deflation surfaces) and east-west trending Woorinen dunes.

<**Subsurface investigations at site**> 14 bores

<**Structural setting**> The basin is located northeast of the Merbein Ridge and southeast of the Mallanbool Ridge (RWC, 1991).

<**Stratigraphic setting**> The basin is floored by the Yamba Formation (2-3 m), and is underlain by the Rufus Formation (0-3 m), the Monoman Formation (Channel Sand) (5 m), the Parilla Sand (50 m), the Bookpurnong Beds (15 m), and the Renmark Group (Geology interpreted from Lawrence, 1973)

<**Host formation**> Yamba Formation

<**Host lithofacies**> Lacustrine clays and salt

<**Aquitard**> Rufus Formation and Bookpurnong Beds

<**Aquitard lithofacies**> Rufus Formation: Weathered sand, calcrete, red silt and clay; Bookpurnong Beds: Dark grey shelly clay

<**Aquifer**> Monoman Formation and Parilla Sand

<**Aquifer lithofacies**> Monoman Formation: Fine to coarse quartz sand; Parilla Sand: Fine to coarse quartz sand

<**Comments**> Seepage into Fletcher's Lake depends upon restriction by surficial clays (Van der Lelij and Erny, 1991)

Summary of Hydrodynamics

<**Distance to Murray or tributary**> Connected to the Murray River via Fletchers-Tuckers Creek

<**Head between basin and river/tributary**>

<Site Name> Fletcher's Lake
<Synonyms>

<**Direction of groundwater flow in regional aquifer**> First, northwest into the lake and then northwest from the lake and away from the Murray River (RWC, 1991)

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**>

<**Thickness of aquitard**> Rufus Formation: 0-3 metres; Bookpurnong Beds: 15 metres

<**kv and kh of aquifer**>

<**EC of aquifer**> Parilla Sand: 39,000 mg/L TDS (Williams, 1993); Monoman Formation/Parilla Sand: 80,400 EC (Bore 1022 DWR Dareton) and 42,000 EC (Bore 1025 DWR Dareton) (Salinity appears to decrease with depth)

<**Porosity of aquifer**>

<**Thickness of aquifer**> Monoman Formation: 5 metres; Parilla Sand: 50 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> Fletchers Lake is located in a deflation basin that has partially eroded through the Rufus Terrace thereby allowing groundwater from the Parilla Sand/Monoman Formation to discharge into the basin. The Monoman Formation and the Parilla Sand form a continuous aquifer in the area (and are thus hard to distinguish from each other) that is recharged by the irrigation mound beneath the Coomealla Irrigation Area, seepage from Holland Lakes, and partly from the irrigation mound beneath the Mildura-Merbein Irrigation Area. Discharge from the Parilla Sand/Monoman Formation occurs around most of the lake, except in the northwest corner where there is seepage back into the aquifer (Van der Lelij and Erny, 1991). Drilling logs at DWR in Dareton, show that the salinity seems to decrease with depth into the aquifer, reflecting the fact that the primary source of water in the Parilla/Monoman is irrigation excess, while the higher salinities reflect the concentration of salt at the lake's surface.

The amount of seepage from the basin is unknown, however it should depend on the thickness of the Rufus Formation (which may be partially or fully eroded beneath the basin), the permeability of the aquifer (high), and the potential within the Parilla Sand/Monoman Formation. Disposal water that does enter the groundwater will be probably be intercepted by the Darling River and then returned to the Murray River.

<**Hydraulic linkage to surface runoff**> Direct flow from Tuckers Creek or Fletchers Creek

<**Category - hydraulic stability**>

<Site Name> Fletcher's Lake
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus> Water budget (Williams and Erny, 1991)

Pumped from Coomealla Irrigation Area	600 ML/yr
Surface flow from Coomealla Irrigation Area	500 ML/yr
Pumped from Curlwaa	600 ML/yr
Precipitation	1020 ML/yr
Groundwater discharge	<4700 ML/yr
Potential evaporation	13,680 ML/yr (1650 mm/yr * 840 Ha)

Interpretive 2

<Ranking of sustainability>

References Cited

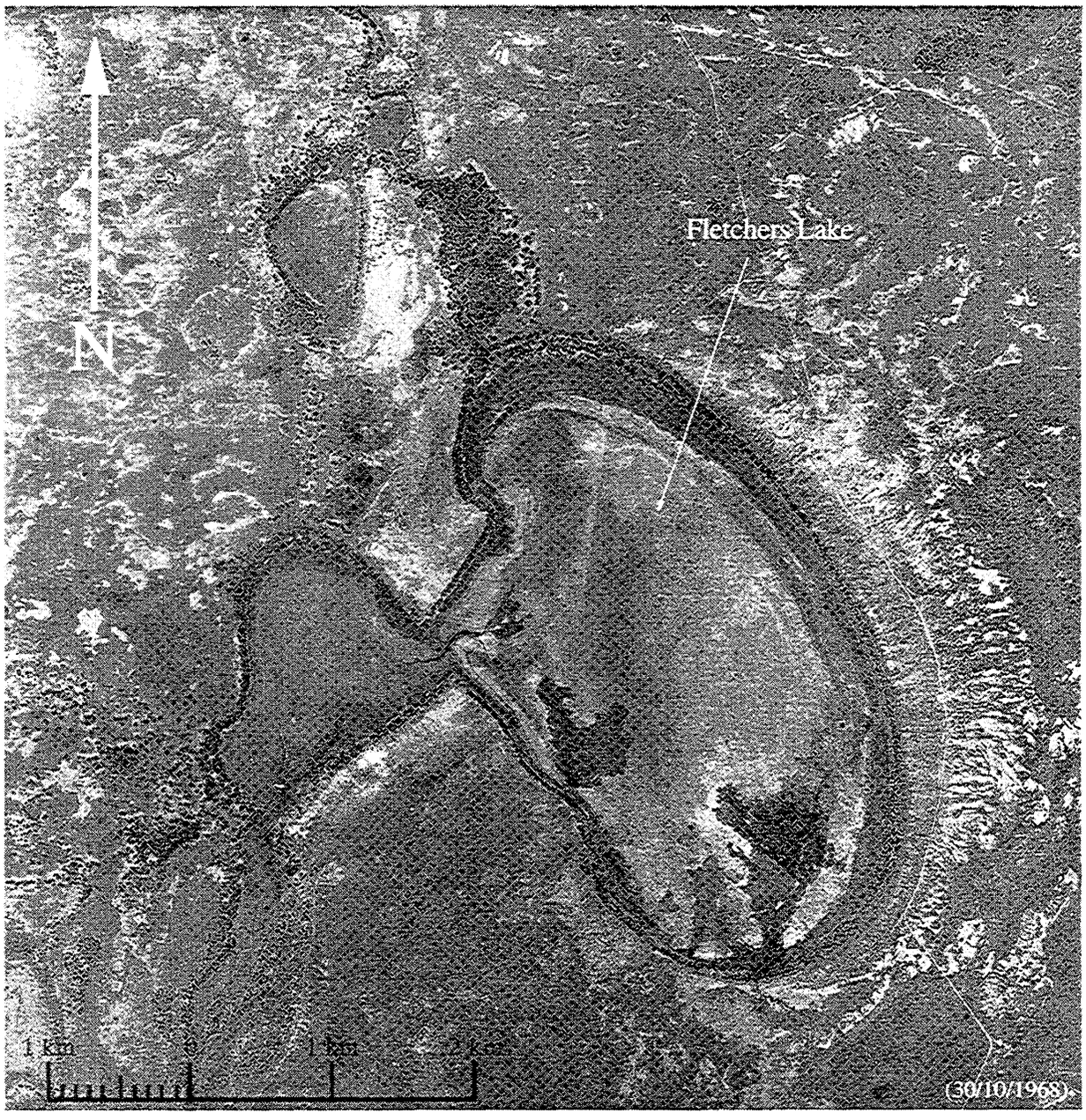
Lawrence, C.R., 1973- Mildura 1:250,000 Geological Map., Mines Department of Victoria, Number 1973/3

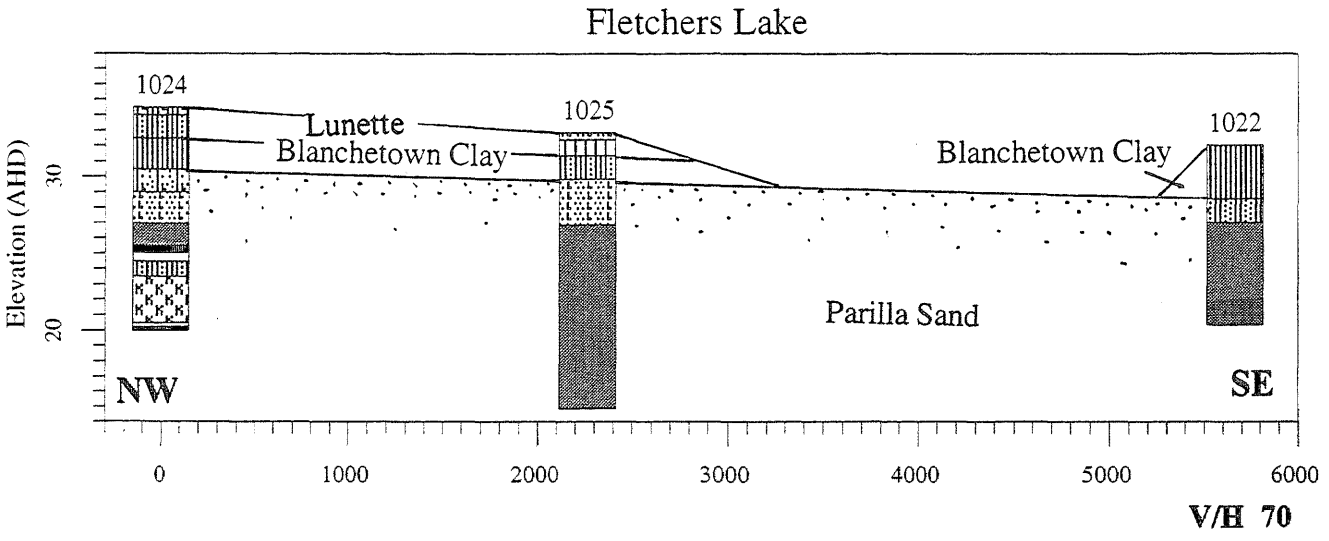
Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

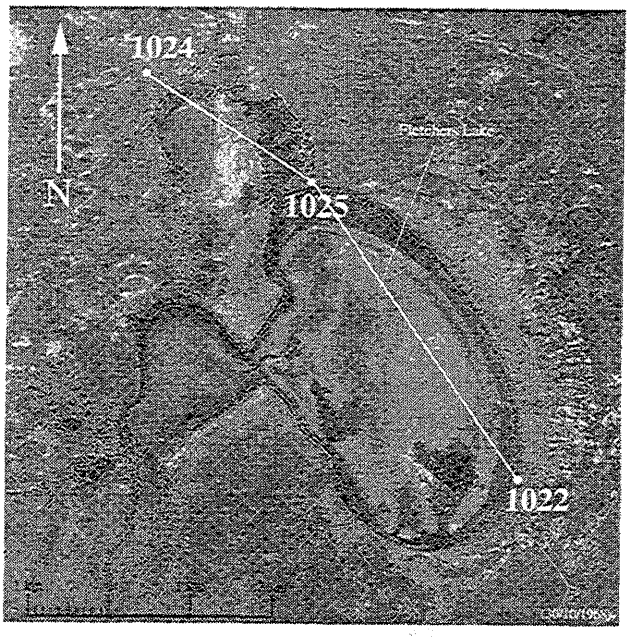
Van der Lelij, A., and Erny, M., 1989- Effect of disposal lakes on groundwater conditions, lower Murray Darling Region-Discussion paper, New South Wales Department of Water Resources Technical Report 89/022.

Williams, R.M., 1993- Evaluation of Disposal Basins by Ranking in New South Wales, Department of Water Resources, Technical Services Division, 26 pp.

Williams, R.M. and Erny, M., 1991- Hydrogeology of the interaction between Pliocene Sand Aquifer and the Darling River Anabranch System., Department of Water Resources Technical Services Division, TS 91/035, 82 p.


N
Fletchers Lake
1 km
0
1 km
2 km
(30/10/1968)


Fletchers Lake
1024
1025
1022
Lunette
Blanchetown Clay
Blanchetown Clay
Parilla Sand
NW
SE
Elevation (AHD)
30
20
0
1000
2000
3000
4000
5000
6000
V/H 70


1024
N
1025
1022

<Site Name> Holland Lakes 1 and 2
<Synonyms>

Spatial

<**Location description**> 7.5 and 8 kilometres ENE of Dareton, NSW in the Coomealla Irrigation Area

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 60330 (L1); 60340 (L2)

<**Coordinates northing (AMG)**> 622900 (L1); 623015 (L2)

<**State**> New South Wales

General

<**Year begun operation**> 1960's

<**Active/inactive**> Active

<**Full surface area (ha)**> 50 ha

<**Volume capacity (ML)**> 300 ML combined lakes 1-4

<**Full surface level (m AHD)**> about 35 m AHD

<**Groundwater level (m AHD)**> 34.5 m AHD (Scott, Williams, and Erny, 1991)

<**Groundwater seepage/discharge**> Seepage: 50% lost to groundwater (Williams, 1993)

<**Average annual evaporation**> 1400 mm/yr (Van der Lelij and Erny, 1989)

<**Volume disposed annually (ML/yr)**> 6000 ML/yr for all lake combined (Williams, 1993)

<**Salinity of water disposed (EC)**> 325-1200 mg/L TDS; average 515 mg/L TDS (Williams, 1993)

<**Range of salinity in basin (EC)**> Current salinity 5850 mg/L TDS (Williams, 1993), 2700 EC average 1985-89 (Van der Lelij and Erny, 1989)

<**Sources of water to be disposed**> Eastern side of the Coomealla Irrigation District, and it also receives irrigation drainage water from open surface drains.

<**Terminal/throughflow basin**> Throughflow

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**> Leakage affects groundwater

<Site Name> Holland Lakes 1 and 2
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> NSW Department of Water Resources

<**Project name**> Coomealla Irrigation Area

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> Gentle elongate WNW-SSE depression, now heavily vegetated with reeds. Actual lakes lie in a deflation depression and have low lunettes along the eastern margin. The surrounding area is covered in E-W trending Woorinen dunes, mallee and saltbush.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located on the Merbein Ridge west of the Danyo Fault (RWC, 1991).

<**Stratigraphic setting**> The basin is floored by the Yamba Formation (2-3 m), surrounded by the Woorinen Formation (5 m), and is underlain by the Parilla Sand (30 m), the Bookpurnong Beds (20 m), and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990)

<**Host formation**> Yamba Formation

<**Host lithofacies**> Lacustrine clays and salt

<**Aquitard**> Bookpurnong Beds

<**Aquitard lithofacies**> Dark grey shelly clay

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Medium to fine sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 7 kilometres

<Site Name> Holland Lakes 1 and 2
<Synonyms>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Northeast away from the Murray River (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Bookpurnong Beds: 20 metres

<kv and kh of aquifer> Parilla Sand: Kh = 5-15 m/day (RWC, 1991), Transmissivity: 500 m^2/day (Van der Lelij and Erny, 1989)

<EC of aquifer> 39 000 mg/L TDS (Williams, 1993)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 30-40 metres

<kv and kh of alluvial aquifer> Woorinen Formation: Kh = 5-15 m/day (RWC, 1991)

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The full level of the basin is unknown, however the Mildura 1:100,000 topographic map places it at about 35 m AHD. Williams (1993), states that there is a 4-5 metre difference in head between the lake and the Parilla Sand, while Scott, Williams, and Erny (1991) have the difference at -1.8 to -0.8 metres (groundwater 33.2 to 34.2 m AHD). Regardless of the correct figure, it is clear that the basin leaks directly into the Parilla Sand, due to the absence of the Blanchetown Clay under the basin. Williams (1993) estimates that seepage is approximately 50% of inflow or 35 KL/ha/day (13 ML/ha/yr), with the rest of the disposal water being evaporated. The water that enters the Parilla Sand flows east-northeast away from the river, west-northwest into Fletchers Lake, and then eventually westwards into the Darling Anabranch (RWC, 1991 and Brodie, 1992).

The lakes probably also receive inflow from the perched aquifer within the Woorinen Formation surrounding the basin, due to accession of irrigation water beneath the Coomealla Irrigation Area. The amount is as yet unquantified, however the low salinity of the lakes (5000 mg/L) suggests that the flow may be quite high (Disposal input equals 6000 ML while seepage out equals 3000 ML and evaporation equals 3000 ML).

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> Holland Lakes 1 and 2
<Synonyms>

<Category - degree of hydraulic isolation> None

<Evaporation surplus> Evaporation surplus equals 1400 mm/yr (2200 mm/yr regional evaporation; 250 mm/yr precipitation, and 0.75 pan factor)

Interpretive 2

<Ranking of sustainability>

References Cited

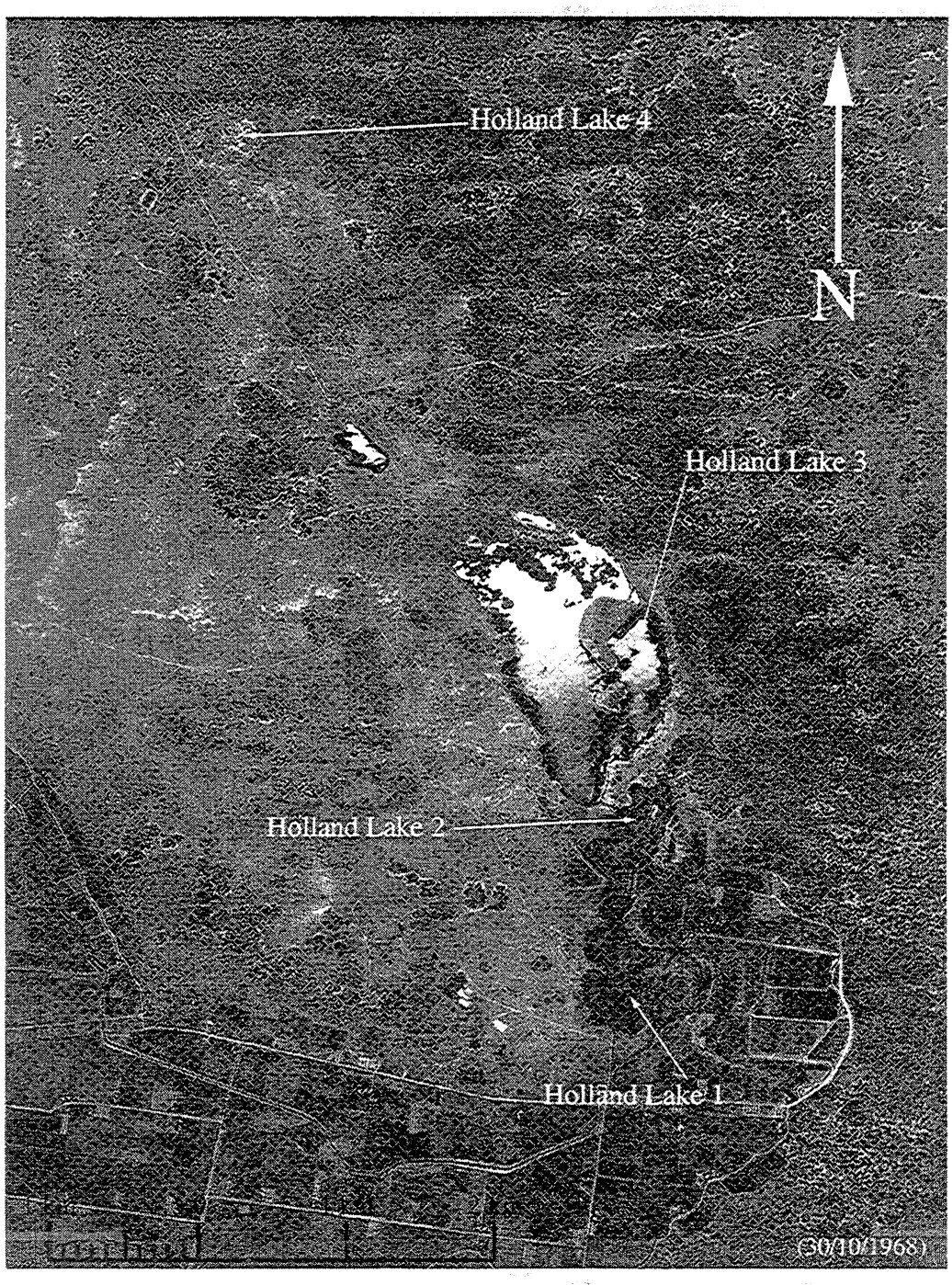
Brodie, R., (AGSO), 1992- ANA BRANCH Hydrogeological Map (1:250 000 scale). Australian Geological Survey Organisation, Canberra, Australia.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Scott, D.I., Williams, R.M., and Erny, M., 1991- Coomealla Irrigation Area pipeline Proposal: A review of the regional groundwater. Department of Water Resources, Technical Unit, 42 p.

Van der Lelij, A., and Erny, M., 1989- Effect of disposal lakes on groundwater conditions, lower Murray Darling Region-Discussion paper, New South Wales Department of Water Resources Technical Report 89/022.

Williams, R.M., 1993- Evaluation of Disposal Basins by Ranking in New South Wales, Department of Water Resources, Technical Services Division, 26 pp.


Holland Lake 4
N
Holland Lake 3
Holland Lake 2
Holland Lake 1
(30/10/1968)

<Site Name> Holland Lake 3
<Synonyms>

Spatial

<**Location description**> 8 kilometres ENE of Dareton, NSW in the Coomealla Irrigation Area

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 603000

<**Coordinates northing (AMG)**> 6231000

<**State**> New South Wales

General

<**Year begun operation**> 1960's

<**Active/inactive**> Active

<**Full surface area (ha)**> 100 ha

<**Volume capacity (ML)**> 300 ML combined lakes 1-4

<**Full surface level (m AHD)**> about 34 m AHD

<**Groundwater level (m AHD)**> 33.0 m AHD (on east) and 33.6 m AHD (on west), Perched aquifer leaking to the Parilla Sand (Van der Lelij and Erny, 1989); 33.2 m AHD on the east and 34.3 m AHD on west (Scott, Williams, and Erny, 1991)

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> 1400 mm/yr (Van der Lelij and Erny, 1989)

<**Volume disposed annually (ML/yr)**> 6000 ML/yr for all lakes combined (Williams, 1993)

<**Salinity of water disposed (EC)**> 325-1200 mg/L TDS; average 515 mg/L TDS (Williams, 1993)

<**Range of salinity in basin (EC)**> Current salinity 5850 mg/L TDS (Williams, 1993), 6820 EC average 1985-89 (Van der Lelij and Erny, 1989)

<**Sources of water to be disposed**> Water disposal and overflow from Lake 2

<**Terminal/throughflow basin**> Throughflow

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**> Leakage affects groundwater

<Site Name> Holland Lake 3
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> New South Wales Department of Water Resources

<**Project name**> Coomealla Irrigation Area

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> Gentle elongate NNW-SSE depression, now heavily vegetated with reeds. The actual lake lies in a deflation depression and has low lunettes along its eastern margin. The surrounding area is covered in E-W trending Woorinen dunes, mallee and saltbush.

<**Structural setting**> The basin is located on the Merbein Ridge and west of the Danyo Fault (RWC, 1991).

<**Stratigraphic setting**> The basin is floored by the Yamba Formation (2-3 m) surrounded by the Woorinen Formation (5 m), and underlain by the Parilla Sand (30 m), the Bookpurnong Beds (20 m), and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Yamba Formation

<**Host lithofacies**> Lacustrine clays and salt

<**Aquitard**> Bookpurnong Beds

<**Aquitard lithofacies**> Dark grey shelly clay

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Medium to fine sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 9 kilometress

<**Head between basin and river/tributary**>

<**Direction of groundwater flow in regional aquifer**> Northeast away from the Murray River (RWC, 1991)

<Site Name> Holland Lake 3
<Synonyms>

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Bookpurnong Beds: 20 metres

<kv and kh of aquifer> Parilla Sand: Kh = 5-15 m/day (RWC, 1991), Transmissivity: 500 m^2/day (Van der Lelij and Erny, 1989)

<EC of aquifer> 39,000 mg/L TDS (Williams, 1993)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 30-40 metres

<kv and kh of alluvial aquifer> Woorinen Formation: Kh = 5-15 m/day (RWC, 1991)

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The full level of the basin is unknown, however the Mildura 1:100,000 topographic map places it at about 34 m AHD. Williams (1993), states that there is a 4-5 metre difference in head between the lake and the Parilla Sand, while Scott, Williams, and Erny (1991) have the difference at +0.2 to -0.8 metres (groundwater 33.2 to 34.2 m AHD). Regardless of the correct figure, it is clear that the basin leaks directly into the Parilla Sand, due to the absence of the Blanchetown Clay under the basin. Williams (1993) estimates that seepage is approximately 50% of inflow or 35 KL/ha/day (13 ML/ha/yr), with the rest of the disposal water being evaporated. The water that enters the Parilla Sand flows east-northeast away from the river, west-northwest into Fletchers Lake, and then eventually westwards into the Darling Anabranch (RWC, 1991 and Brodie, 1992).

The lakes probably also receive inflow from the perched aquifer within the Woorinen Formation surrounding the basin, due to accession of irrigation water beneath the Coomealla Irrigation Area. The amount is as yet unquantified, however the low salinity of the lakes (5000 mg/L) suggests that the flow may be quite high (Disposal input equals 6000 ML while seepage out equals 3000 ML and evaporation equals 3000 ML).

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Site Name> Holland Lake 3
<Synonyms>

<Evaporation surplus> Evaporation surplus equals 1400 mm/yr (2200 mm/yr regional evaporation; 250 mm/yr precipitation, and 0.75 pan factor)

Interpretive 2

<Ranking of sustainability>

References Cited

Brodie, R., (AGSO), 1992- ANA BRANCH Hydrogeological Map (1:250 000 scale). Australian Geological Survey Organisation, Canberra, Australia.

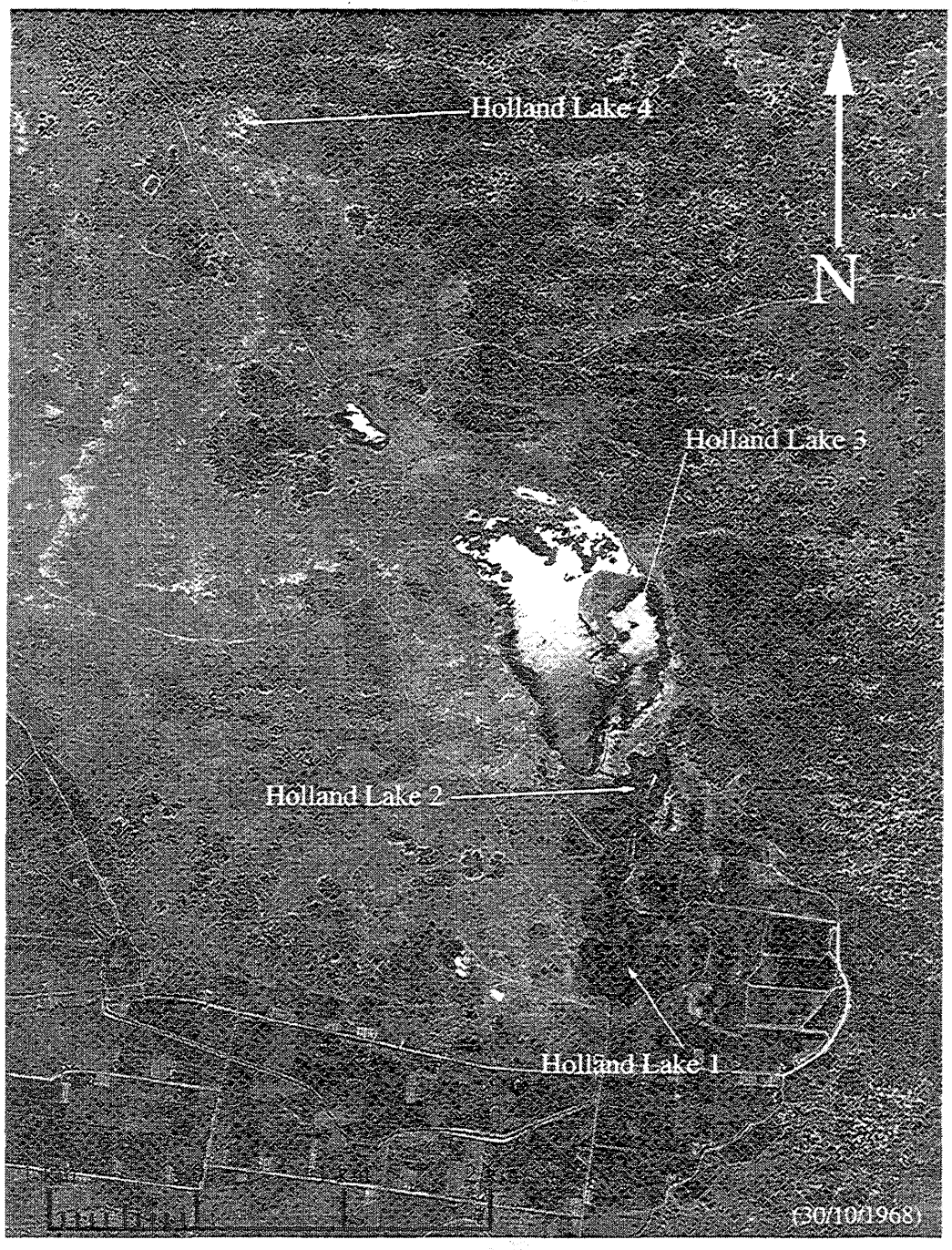
Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Scott, D.I., Williams, R.M., and Erny, M., 1991- Coomealla Irrigation Area pipeline Proposal: A review of the regional groundwater. Department of Water Resources, Technical Unit, 42 p.

Van der Lelij, A., and Erny, M., 1989- Effect of disposal lakes on groundwater conditions, lower Murray Darling Region-Discussion paper, New South Wales Department of Water Resources Technical Report 89/022.

Williams, R.M., 1993- Evaluation of Disposal Basins by Ranking in New South Wales, Department of Water Resources, Technical Services Division, 26 pp.

R9500405


Holland Lake 4
N
Holland Lake 3
Holland Lake 2
Holland Lake 1
(30/10/1968)

<Site Name> Holland Lake 4
<Synonyms>

Spatial

<**Location description**> 8 kilometres ENE of Dareton, NSW in the Coomealla Irrigation Area

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 601350

<**Coordinates northing (AMG)**> 6233000

<**State**> New South Wales

General

<**Year begun operation**> 1980's

<**Active/inactive**> Active

<**Full surface area (ha)**> 50 ha

<**Volume capacity (ML)**> 300 ML combined lakes 1-4

<**Full surface level (m AHD)**> about 35 m AHD

<**Groundwater level (m AHD)**> 34.1 m AHD (Scott, Williams, and Erny, 1991)

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> 1400 mm/yr (Van der Lelij and Erny, 1989)

<**Volume disposed annually (ML/yr)**> 6000 ML/yr for all lake combined (Williams, 1993)

<**Salinity of water disposed (EC)**> 325-1200 mg/L TDS; average 515 mg/L TDS (Williams, 1993)

<**Range of salinity in basin (EC)**> Current salinity 5850 mg/L TDS (Williams, 1993), 1430 EC average 1985-89 (Van der Lelij and Erny, 1989)

<**Sources of water to be disposed**> Disposal; water from the other Holland Lakes

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**> 0.9 metre seasonal fluctuation (van der Lelij and Erny, 1989)

<**Lining/treatment of base**> None

<**Review of environmental impacts**> Leakage affects groundwater

<Site Name> Holland Lake 4
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> New South Wales Department of Water Resources

<**Project name**> Coomealla Irrigation Area

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**>

Geological

<**Site description and Geomorphology**> The lake is nearly circular with dead trees in the centre due to rising groundwater levels. Actual lake lies in a deflation depression and has a low lunette along its eastern margin. The surrounding area is covered in E-W trending Woorinen dunes, mallee and saltbush.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located on the Merbein Ridge west of the Danyo Fault (RWC, 1991).

<**Stratigraphic setting**> The basin is floored by the Yamba Formation (2-3 m), surrounded by the Woorinen Formation (5 m), and underlain by the Parilla Sand (30 m), the Bookpurnong Beds (20 m), and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Yamba Formation

<**Host lithofacies**> Lacustrine clays and salt

<**Aquitard**> Bookpurnong Beds

<**Aquitard lithofacies**> Dark grey shelly clay

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Medium to fine sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 8 kilometres

<**Head between basin and river/tributary**>

<Site Name> Holland Lake 4
<Synonyms>

<**Direction of groundwater flow in regional aquifer**> Groundwater flows northeast, NNW, and northwest away from the Murray River (Scott, Williams, and Erny, 1991).

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**>

<**Thickness of aquitard**> Bookpurnong Beds: 20 metres

<**kv and kh of aquifer**> Parilla Sand: Kh = 5-15 m/day (RWC, 1991), Transmissivity = 500 m^2/day (Van der Lelij and Erny, 1989)

<**EC of aquifer**> 39,000 mg/L TDS (Williams, 1993)

<**Porosity of aquifer**>

<**Thickness of aquifer**> Parilla Sand: 30-40 metres

<**kv and kh of alluvial aquifer**> Woorinen Formation: Kh = 5-15 m/day (RWC, 1991)

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> The full level of the basin is unknown, however the Mildura 1:100,000 topographic map places it at about 35 m AHD. Williams (1993), states that there is a 3-4 metre difference in head between the lake and the Parilla Sand, while Scott, Williams, and Erny (1991) have the difference at -1.8 to -0.8 metres (groundwater 33.2 to 34.2 m AHD). Regardless of the correct figure, it is clear that the basin leaks directly into the Parilla Sand, due to the absence of the Blanchetown Clay under the basin. Williams (1993) estimates that seepage is approximately 50% of inflow or 35 KL/ha/day (13 ML/ha/yr), with the rest of the disposal water being evaporated. The water that enters the Parilla Sand flows east-northeast away from the river, west-northwest into Fletchers Lake, and then eventually westwards into the Darling Anabranch (RWC, 1991 and Brodie, 1992).

The lakes probably also receive inflow from the perched aquifer within the Woorinen Formation surrounding the basin, due to accession of irrigation water beneath the Coomealla Irrigation Area. The amount is as yet unquantified, however the low salinity of the lakes (5000 mg/L) suggests that the flow may be quite high (Disposal input equals 6000 ML while seepage out equals 3000 ML and evaporation equals 3000 ML).

<**Hydraulic linkage to surface runoff**>

<**Category - hydraulic stability**>

<Site Name> Holland Lake 4
<Synonyms>

<Category - degree of hydraulic isolation> None

<Evaporation surplus> Evaporation surplus equals 1400 mm/yr (2200 mm/yr regional evaporation; 250 mm/yr precipitation, and 0.75 pan factor)

Interpretive 2

<Ranking of sustainability>

References Cited

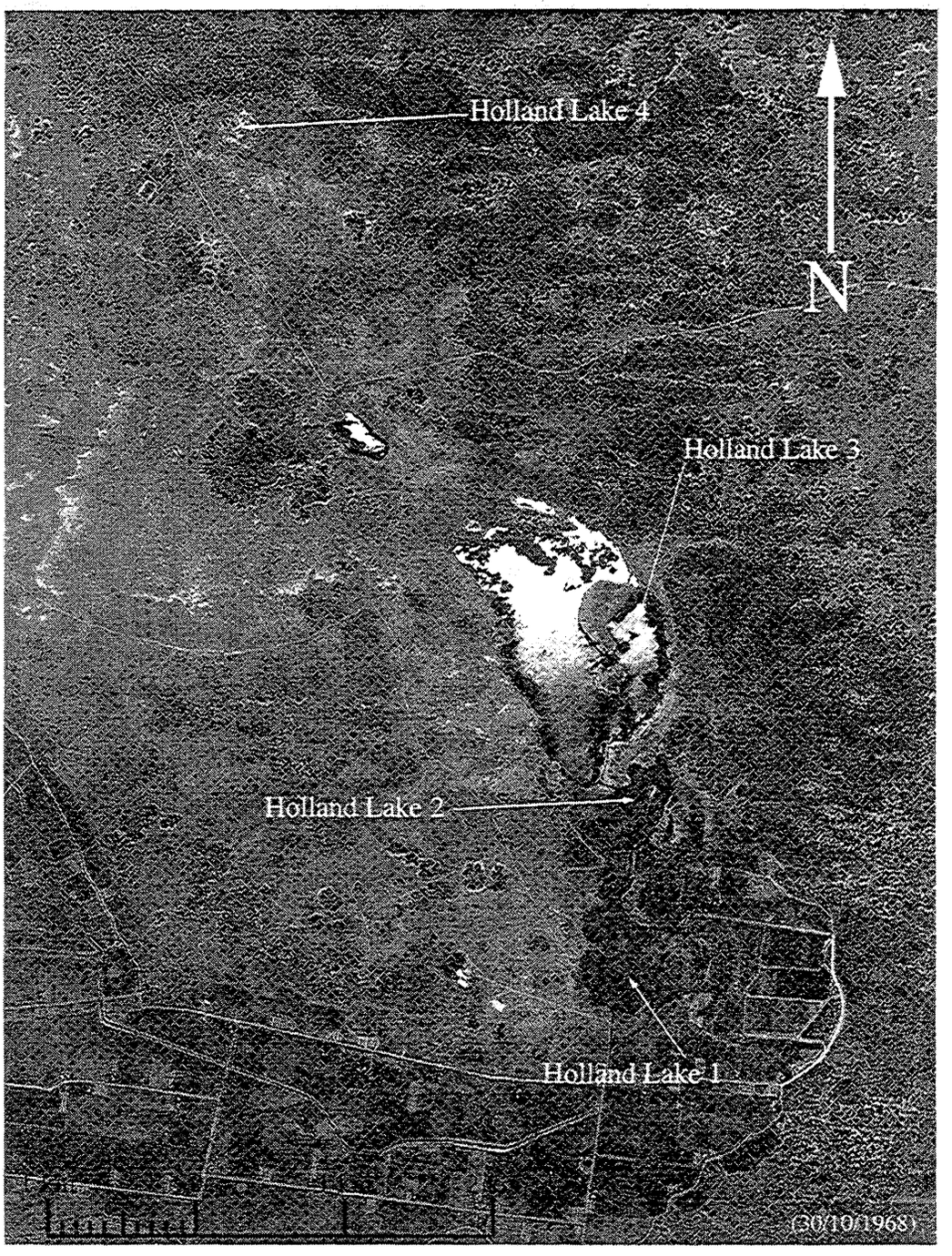
Brodie, R., (AGSO), 1992- ANA BRANCH Hydrogeological Map (1:250 000 scale). Australian Geological Survey Organisation, Canberra, Australia.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Scott, D.I., Williams, R.M., and Erny, M., 1991- Coomealla Irrigation Area pipeline Proposal: A review of the regional groundwater. Department of Water Resources, Technical Unit, 42 p.

Van der Lelij, A., and Erny, M., 1989- Effect of disposal lakes on groundwater conditions, lower Murray Darling Region-Discussion paper, New South Wales Department of Water Resources Technical Report 89/022.

Williams, R.M., 1993- Evaluation of Disposal Basins by Ranking in New South Wales, Department of Water Resources, Technical Services Division, 26 pp.


Holland Lake 4
N
Holland Lake 3
Holland Lake 2
Holland Lake 1
(30/10/1968)

<Site Name> Mallee Cliffs Salt Interception Scheme
<Synonyms>

Spatial

<**Location description**> 14 kilometres NNE of Lamberts Island and 10 kilometres east of Buronga along the Sturt Highway

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 635500

<**Coordinates northing (AMG)**> 6211500

<**State**> New South Wales

General

<**Year begun operation**> 1994

<**Active/inactive**>Active

<**Full surface area (ha)**> Two basins 74 ha and 26 ha

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> 59 m AHD, to operate at a depth of 2 metres

<**Groundwater level (m AHD)**>

<**Groundwater seepage/discharge**>

<**Average annual evaporation**> 1350 mm evaporation, 304 mm precipitation (Dames and Moore, 1989)

<**Volume disposed annually (ML/yr)**> To intercept salt load the system will need to pump 35 ML/day (12,775 ML/yr) (Williams and Hamilton, 1992)

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**>

<**Sources of water to be disposed**> Groundwater interception coming from Parilla Sand to stop 100 tonnes/day of salt from entering Murray River

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> Clay banks built, interception wall around perimeter of basin, and clay lining of basin

<**Review of environmental impacts**> Adjacent to Mallee Cliffs National Park, so extra care has been taken to avoid contamination of the park. These include planting of salt intercepting trees, an interception wall and trench around the basin and emergency overflow storage.

<**Site Name**> Mallee Cliffs Salt Interception Scheme
<**Synonyms**>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> New South Wales Department of Water Resources

<**Project name**> Mallee Cliffs Interception Scheme

<**Natural, modified natural or constructed**> Constructed

<**Modification type and degree**>

Geological

<**Site description and Geomorphology**> Two shallow basinal areas divided by a low sand ridge and surrounded by dune ridges. Confined by E-W trending ridgelines. In the north the basin is bounded by an east-west trending saddle with minimum surface elevation of 1.5 metres above datum. Vegetation consists of cleared and intact mallee association (Dames and Moore, 1989)

<**Subsurface investigations at site**> Numerous bores and trenches dug to determine site geology.

<**Structural setting**> The basin is located east of the Neckarboo Ridge and within the Raak Trough (RWC, 1991).

<**Stratigraphic setting**>The basin is floored by the Woorinen Formation (0.5-2 metres), and underlain by the Blanchetown Clay (0-8 metres), the Parilla Sand (40 m), the Bookpurnong Beds/Geera Clay, and the Renmark Group (Geology interpreted from Dames and Moore, 1988).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Silty clay or sandy clay, sandy clay loams

<**Aquitard**> None in centre of basin (Dames and Moore, 1989), although Blanchetown Clay does surround basin with a thickness of 6-8 metres in the borrow pits.

<**Aquitard lithofacies**> Blanchetown Clay: grey plastic clay and silty clay with occasional sand lenses (foresets intact) of reworked Parilla Sand covered by clay drapes, and thin beds (3-5 cm) dolomite.

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Grey, well sorted, medium to coarse grained , quartz sand, with some clay content that may have been washed in from the Blanchetown Clay.

<**Comments**> May have been a discharge zone in the past, has higher soil salinities (400-600 EC) than surrounding mallee (Dames and Moore, 1989).

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 13.5 kilometres

<**Head between basin and river/tributary**>

<Site Name> Mallee Cliffs Salt Interception Scheme
<Synonyms>

<**Direction of groundwater flow in regional aquifer**> Southwest, although deflected by basement high to the west of the basin and directed to the SSE and the Murray River (Dames and Moore, 1989).

<**kv of artificial floor**>

<**kv and kh of host**> Woorinen Formation: 2.5 x 10^{-4} m/day (Dames and Moore, 1989)

<**kv and kh of aquitard**>

<**Thickness of aquitard**> Blanchetown Clay: 0-8 metres

<**kv and kh of aquifer**> Parilla Sand: Transmissivity = 1500-2000 m^2/day (Dames and Moore, 1989), In Bore 36880/1 Transmissivity = 346 m^2/day straight line and 289 m^2/day residual; and in Bore 36880/2 Transmissivity = 413 m^2/day straight line and 320 m^2/day residual (Williams and Hamilton, 1992).

<**EC of aquifer**> Parilla Sand: 40,000-60,000 EC (Dames and Moore, 1989), 52,500 EC (Williams and Hamilton, 1992)

<**Porosity of aquifer**>

<**Thickness of aquifer**> Parilla Sand: 40 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**> Head in Parilla Sand is 0.7 metres above alluvial aquifer (Williams and Hamilton, 1992)

Interpretive 1

<**Hydraulic linkage to regional aquifer**> Mallee Cliffs Basin is designed to concentrate the disposal water and then allow it to re-enter the Parilla Sand as a dense brine (which will not move). The performance of the basin is presently unknown because it has just begun operation, so it is difficult to ascertain the eventual effects of the scheme. A successful operation will depend on the rate at which the basin leaks, both into the Parilla Sand and into the perched aquifer in the Woorinen Formation. If the leakage into the Parilla Sand is too fast the basin will quickly become obsolete, and if there is significant seepage into the perched watertable localised areas around the basin may become salinised. There has been extensive investigation into the design and geology of the basin, the next test will come with continued operation (Dames and Moore, 1989).

<**Hydraulic linkage to surface runoff**> Although there are sand-filled cracks (dessication cracks) that penetrate the ground up to 3 metres they seem to have no bearing on flow. Instead. there is preferential flow within the surface soil (Dames and Moore, 1989).

<**Category - hydraulic stability**>

<Site Name> Mallee Cliffs Salt Interception Scheme
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

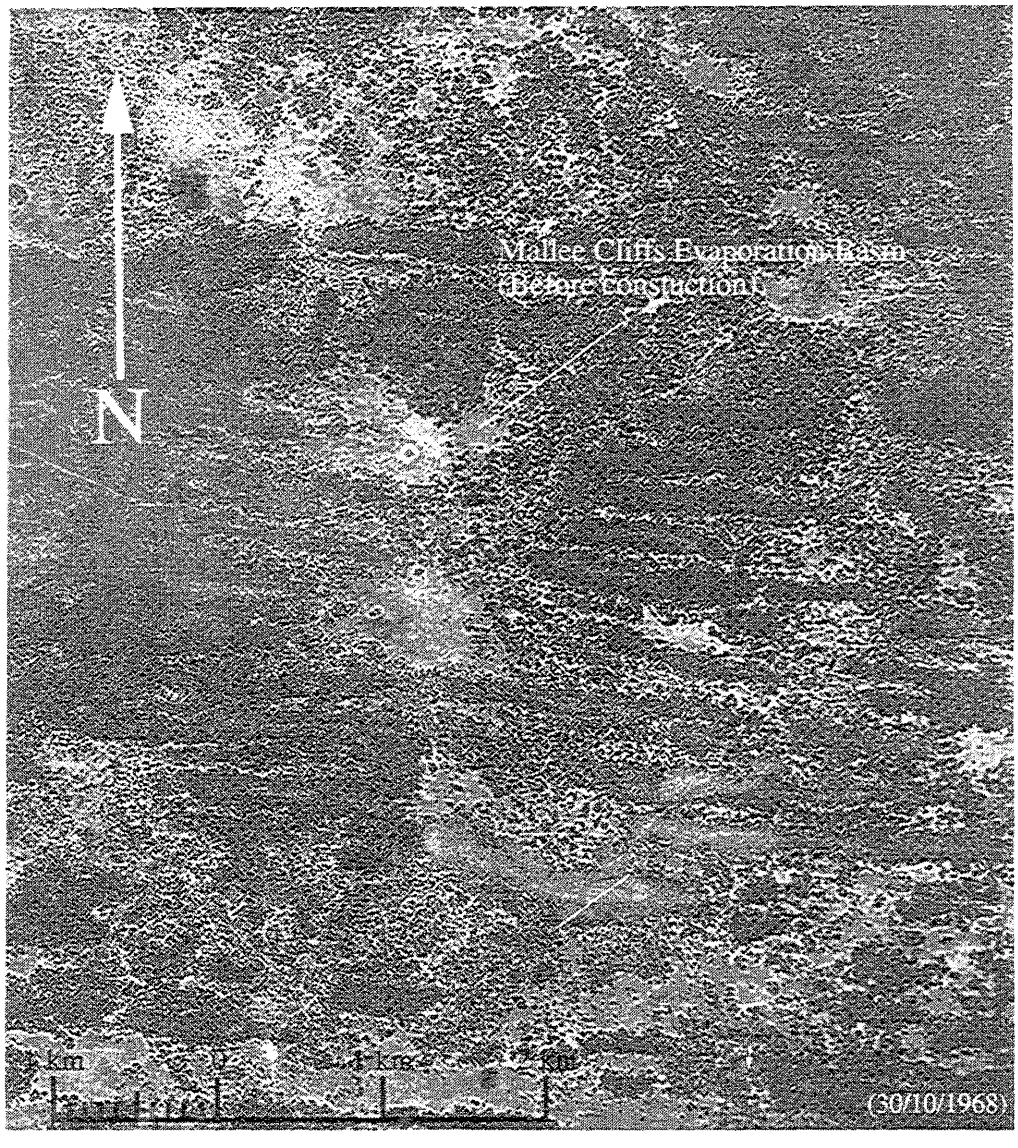
Bish, S., and Williams, R.M., 1992- Mallee Cliffs Salt Interception Scheme: Installation of production bores and review of hydrogeological conditions., Department of water Resources Technical Services Division, TS 92/042, 40 p.

Dames and Moore, 1989- Mallee Cliffs Interception Project Draft Environmental Impact Statement., Department of Water Resources, 14213.004, 68 p.

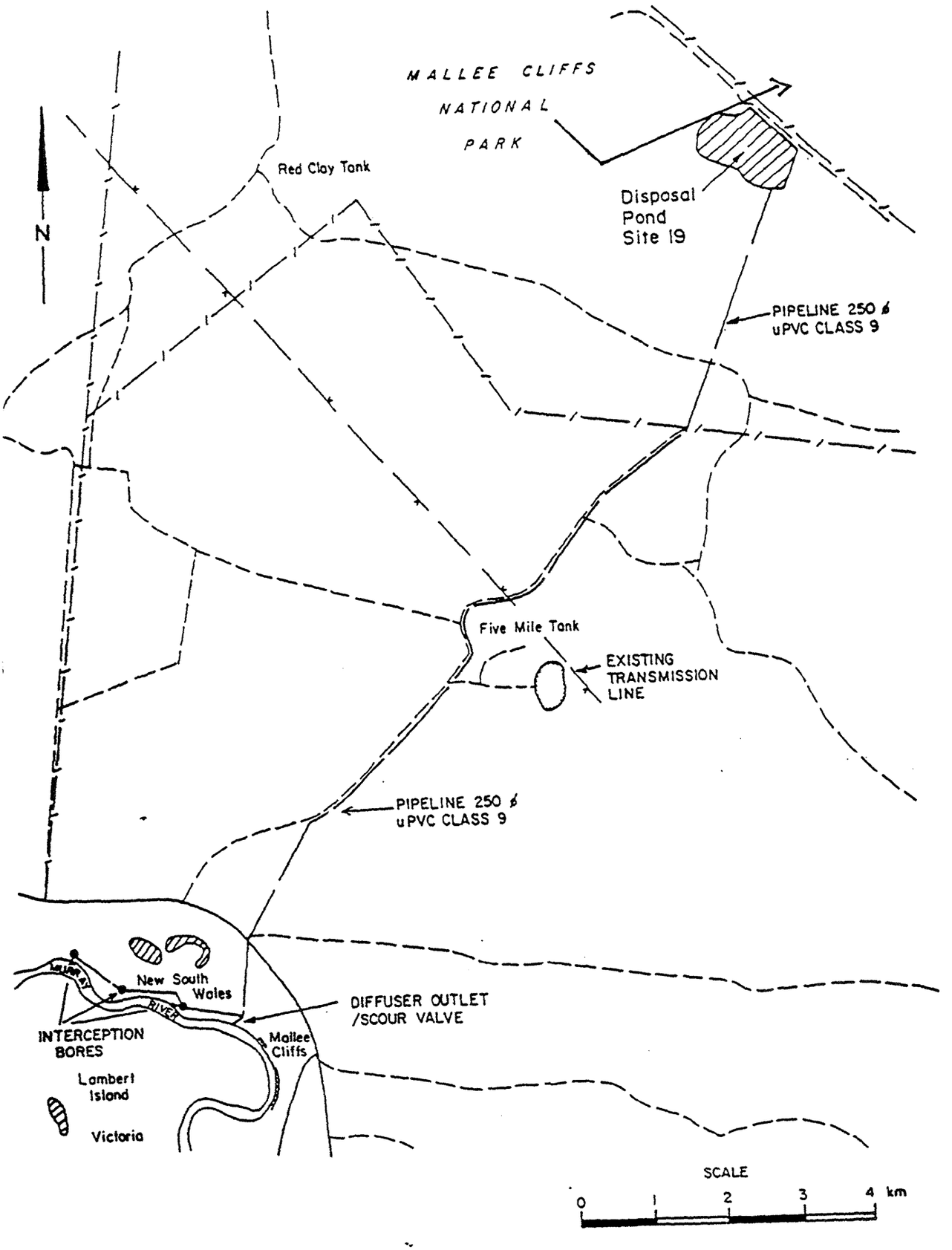
Dames and Moore, 1989b- Mallee Cliffs Salt Interception Scheme Preliminary Design Report. Department of Water Resources, 14213.004.070, 75 p.

Dames and Moore, 1988- Mallee Cliffs Salt Interceptions Project preparation of environmental impact statement stage 1a site assessment report, Department of Water Resources, 14213-03

Williams, R.M., and Hamilton, S.T., 1990- Mallee Cliffs Salt interception Scheme: Review of hydrogeological conditions., Department of Water Resources Technical Services Division, TS 92/011, 123 p.


Mallee Cliffs Evaporation Basin
(before construction)
N
km
km
km
(30/10/1968)

Mallee Cliffs Salt Interception Scheme



(Dames and Moore, 1988)

<Site Name> Mirrool Farm 196
<Synonyms>

Spatial

<**Location description**> 6 kilometres SW of Griffith, NSW and 5 kilometres WNW of Hanwood, NSW

<**Located in Murray Trench**> No

<**Location 1:250 000**> Narrandera

<**Location 1:100 000**> Kooroongal

<**Zone**> 55H

<**Coordinates easting (AMG)**> 407350

<**Coordinates northing (AMG)**> 6101200

<**State**> New South Wales

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**>

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**>

<**Groundwater level (m AHD)**>

<**Groundwater seepage/discharge**>

<**Average annual evaporation**> 1702 mm/yr (CSIRO, Griffith)

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**>

<**Sources of water to be disposed**> Irrigation

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**>

<**Review of environmental impacts**>

<Site Name> Mirrool Farm 196
<Synonyms>

Engineering/Admin

<**Public or private operation**> Private

<**Agency responsible**> New South Wales Department of Water Resources

<**Project name**> Farm 196

<**Natural, modified natural or constructed**>

<**Modification type and degree**>

Geological

<**Site description and Geomorphology**> The basin is located within the agricultural belt around Griffith, NSW among the low hills and valleys of the Shepparton Formation.

<**Subsurface investigations at site**> 3 bores DWR, Griffith

<**Structural setting**> West of the Griffith Syncline and east of the Griffith? Anticline (Wynn, 1962)

<**Stratigraphic setting**> The basin is floored by the Shepparton Formation (40 m), and is underlain by the Calivil Formation (60 m), and the Renmark group (100 m) (Wynn, 1962).

<**Host formation**> Shepparton Formation

<**Host lithofacies**> Medium to heavy clay (Bore 1740, DWR, Griffith)

<**Aquitard**> Shepparton Formation

<**Aquitard lithofacies**> Medium to heavy clay (Bore 1740, DWR, Griffith)

<**Aquifer**> Shepparton Formation, Calivil Formation, Renmark Group

<**Aquifer lithofacies**> Shepparton Formation: Clayey sand and sandy clay; Calivil Formation: Poorly sorted gravel, coarse sand, and some clay (kaolin); Renmark Group: Carbonaceous silt, siltstone, sand, clay, and lignite (Brown and Stephenson, 1991)

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> Only connected to the Murray River in a regional sense all drainage goes to Barren Box Swamp.

<**Head between basin and river/tributary**>

<**Direction of groundwater flow in regional aquifer**> West and southwest (Woolley, 1991)

<**kv of artificial floor**>

<Site Name> Mirrool Farm 196
<Synonyms>

<kv and kh of host> Shepparton Formation: Kv <3 x 10^{-3} m/day (DWR bore, and Les Ellis, pers. comm.)

<kv and kh of aquitard> Shepparton Formation: Kv <3 x 10^{-3} m/day (DWR bore, and Les Ellis, pers. comm.)

<Thickness of aquitard> Depends on local geometry of Shepparton Formation

<kv and kh of aquifer> Shepparton: Kh: 1 m/day (DWR bore); Calivil Formation: Kh: 30-40 m/day, Kv: 0.3 m/day (J. Kellet, pers. comm.)

<EC of aquifer> Shepparton Formation: 9750 mg/L TDS (Williams, 1993); Calivil Formation: 1000-1500 mg/L; Renmark Group: < 500 mg/L (Woolley, 1991)

<Porosity of aquifer>

<Thickness of aquifer> Shepparton Formation: Variable depends on the presence or absence of prior stream sand bodies; Calivil Formation: 60 metres; Renmark Group: 100 metres.

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Water that enters the Shepparton Formation will flow towards Barren Box Swamp, a regional catchment. From there, water can enter the Calivil Formation and the Renmark Group (and thus the Murray Basin) due to the higher head within the Shepparton (Woolley, 1991). Salinities involved, are in a basin wide perspective low (3000-7000 EC), but it is estimated that the Griffith Area provides about 16.9 EC at Morgan (Annual cost at border 1.3 million dollars (National Environmental Consultancy, 1987)).

<Hydraulic linkage to surface runoff> Overflow or disposal into Mirrool Creek flows into Barren Box Swamp, an isolated catchment area with no surface connection to the Murrumbidgee River. Water is held in Barren Box Swamp until it is able to infiltrate into the Renmark Group aquifer.

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

<Site Name> Mirrool Farm 196
<Synonyms>

Interpretive 2

<Ranking of sustainability>

References Cited

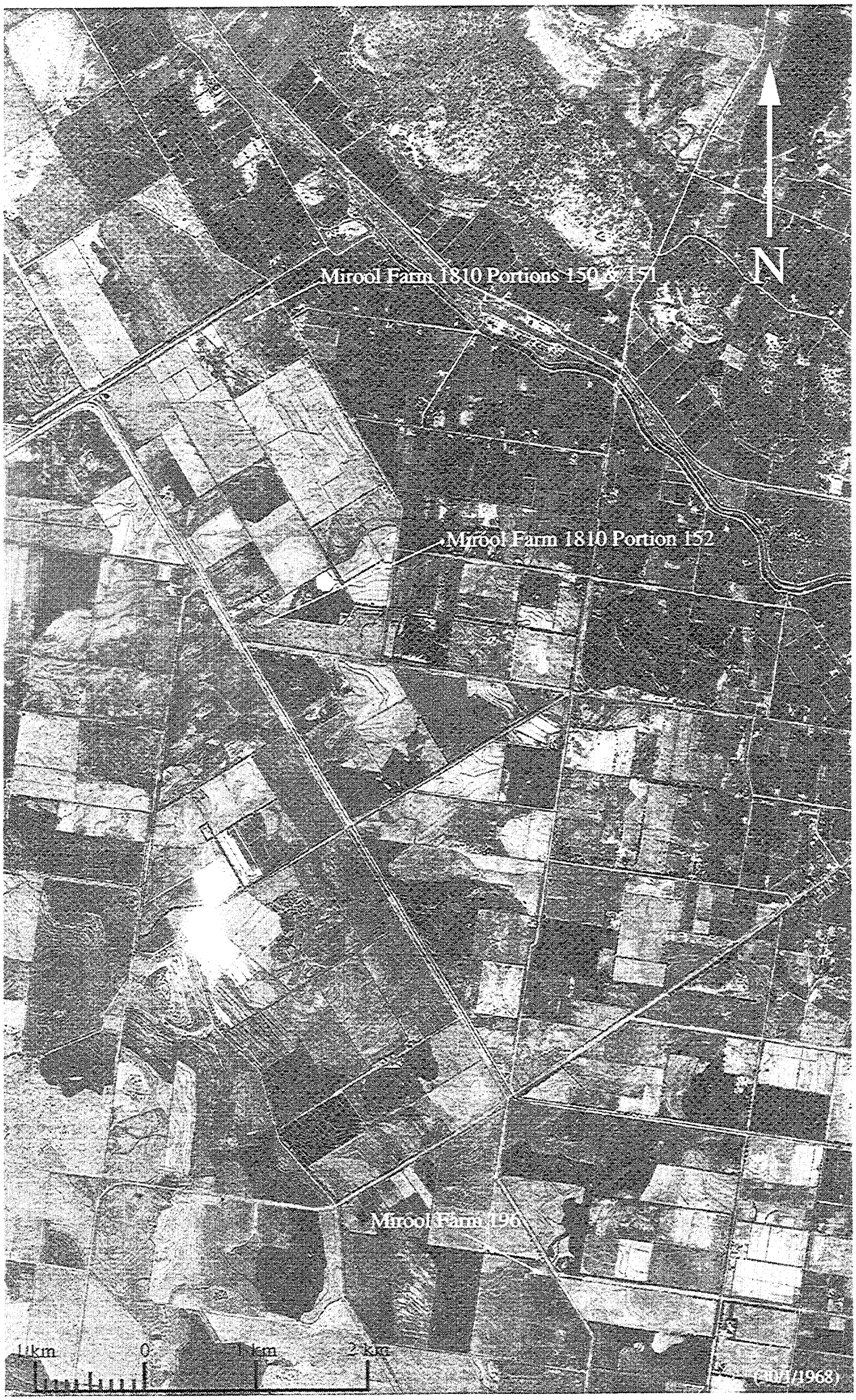
Brown, C.M., and Stephenson, A.E., 1991- Geology of the Murray Basin, Southeastern Australia., Bureau of Mineral Resources, Geology and Geophysics, BMR Bulletin 235, (Australian Government Publishing Services, Canberra)

National Environmental Consultancy, 1987- Chowilla Salinity Mitigation Scheme: Draft Environmental Impact Statement, South Australia Engineering and Water Supply,

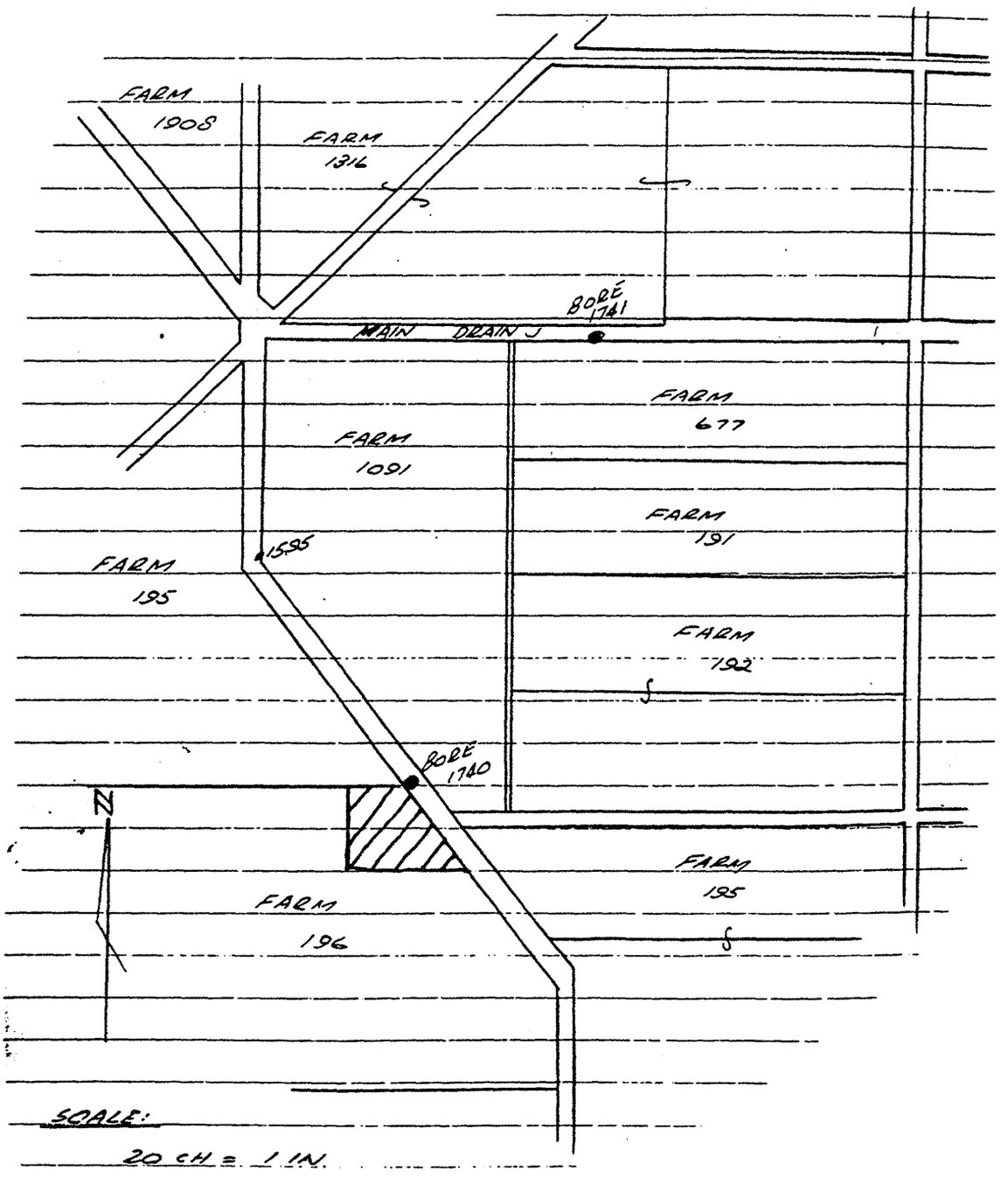
Williams, R.M., 1993- Evaluation of Disposal Basins by Ranking in New South Wales, Department of Water Resources, Technical Services Division, 26 pp.

Woolley, D., (Department of Water Resources, NSW), 1991- Narrandera Hydrogeological Map (1:250,000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Wynn, D.W., 1962- Narrandera- 4 mile Geological Series., The Geological Survey of New South Wales, Sheet I55/10 Zone 7, Australian National Grid.


Mirool Farm 1810 Portions 150 & 151
N
Mirool Farm 1810 Portion 152
Mirool Farm 196
1 km
0
1 km
2 km
(2003/1968)

Farm 196



(DWR, Griffith)

<Site Name> Farm 1061
<Synonyms> Mirrool Farm 1061
Stubbings

Spatial

<Location description> 10 kilometre south of Griffith along the Darlington Point Road

<Located in Murray Trench> No

<Location 1:250 000> Narrandera

<Location 1:100 000> Griffith 8129

<Zone> 55H

<Coordinates easting (AMG)> 408400

<Coordinates northing (AMG)> 6194150

<State> New South Wales

General

<Year begun operation> 1984

<Active/inactive> Active

<Full surface area (ha)> 1-2 ha

<Volume capacity (ML)>

<Full surface level (m AHD)> ~121 m AHD

<Groundwater level (m AHD)> 120.59 to 120.81 m AHD (1/87)

<Groundwater seepage/discharge> Seepage

<Average annual evaporation> 1702 mm/yr (CSIRO, Griffith)

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)> 33 000 mg/L TDS (Williams, 1993)

<Range of salinity in basin (EC)> 12 350 mg/L TDS (Williams, 1993); 130,000 EC (5/86)

<Sources of water to be disposed> Onsite tile drainage from the farm

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal> Bore 2808 from 120.03 m AHD (7/84) to 120.87 m AHD (8/87)

<Lining/treatment of base>

<Review of environmental impacts> Basin practically dry

<Site Name> Farm 1061
<Synonyms> Mirrool Farm 1061
Stubbings

Engineering/Admin

<Public or private operation> Private

<Agency responsible> Department of Water Resources

<Project name> Farm 1061

<Natural, modified natural or constructed> Modified natural

<Modification type and degree>

Geological

<Site description and Geomorphology> The basin sits on the edge of Mirrool Creek and is surrounded by rice farming terraces cut into the Shepparton Formation.

<Subsurface investigations at site> 5 bores and 20 piezometers

<Structural setting> The basin is located west of the Griffith Syncline and east of the Griffith? Anticline (Wynn, 1962).

<Stratigraphic setting> The basin is floored by the Shepparton Formation (40 m), and underlain by the Calivil Formation (60 m) and the Renmark Group (100 m) (Woolley, 1991).

<Host formation> Shepparton Formation

<Host lithofacies> Medium clay to heavy clay (DWR piezometer logs, Griffith)

<Aquitard> Shepparton Formation

<Aquitard lithofacies> Medium clay to heavy clay (DWR piezometer logs, Griffith)

<Aquifer> Shepparton Formation, Calivil Formation, Renmark Group

<Aquifer lithofacies> Shepparton Formation: Fine to coarse sand in shoestring sand bodies (prior streams), Calivil Formation: Poorly sorted gravel, coarse sand, and some clay (kaolin), Renmark Group: Carbonaceous silt, siltstone, sand, clay, and lignite (Brown and Stephenson, 1991)

<Comments>

Summary of Hydrodynamics

<Distance to Murray or tributary> Surface drainage goes into an isolated catchment system (Barren Box Swamp), and is only connected to the River Murray by the Renmark Group aquifer.

<Head between basin and river/tributary> <0.5 metre

<Direction of groundwater flow in regional aquifer> WSW (Woolley, 1991)

<Site Name> Farm 1061
<Synonyms> Mirrool Farm 1061
Stubbings

<kv of artificial floor>

<kv and kh of host> Shepparton Formation: Kv <3 x 10^{-3} m/day (DWR bore logs, and L. Ellis, pers. comm.)

<kv and kh of aquitard> Shepparton Formation: Kv <3 x 10^{-3} m/day (DWR bore logs, and L. Ellis, pers. comm.)

<Thickness of aquitard> Variable depending on the thickness and presence of the shoestring sand bodies

<kv and kh of aquifer> Calivil Formation: Kv = 0.3 m/day, Kh = 30-40 m/day (J. Kellet, pers. comm.); Shepparton Formation: Transmissivity = 56.5 m^2/day (DWR bore 3295, Griffith)

<EC of aquifer> Shepparton Formation: 9750 mg/L TDS (Williams, 1993); Calivil Formation: 1000-1500 mg/L; Renmark Group: < 500 mg/L (Woolley, 1991); Shepparton Formation (prior stream sand): 18,200 EC (DWR bore 3295, Griffith)

<Porosity of aquifer>

<Thickness of aquifer> Shepparton Formation: Variable depending on presence or absence of shoestring sand bodies; Calivil Formation: 60 metres; Renmark Group: 100 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The potentiometric surface in the Shepparton Formation is 0 to 0.30 metres below the bottom of the basin. The higher watertable presumably coincides with flooding of the basin during disposal (3-4 months per year), while the low level corresponds to when the basin is dry (most of the year). The effect of the leakage should be quite low due to the low salinity of the drainage disposal (2,000-3,000 EC), the small area drained (1 farm), the short period of disposal, and the low hydraulic head. The high salinities in the basin (155,000 to 228,000 EC) is the result of the basin drying out between rice harvests and is not indicative of full conditions.

Water that does enter the Shepparton Formation will flow towards Barren Box Swamp, a regional catchment. From there, water can enter the Calivil Formation and the Renmark Group (and thus the Murray Basin) due to the higher head within the Shepparton (Woolley, 1991). Salinities involved, are in a basin wide perspective low (3000-7000 EC), but it is estimated that the Griffith Area provides about 16.9 EC at Morgan (Annual cost at border 1.3 million dollars (National Environmental Consultancy, 1987)).

<Hydraulic linkage to surface runoff> Overflow or disposal into Mirrool Creek flows into Barren Box Swamp, an isolated catchment area with no surface connection to the Murrumbidgee River. Water is held in Barren Box Swamp until it is able to infiltrate into the Renmark Group aquifer.

<Category - hydraulic stability>

<Site Name> Farm 1061
<Synonyms> Mirrool Farm 1061
Stubbings

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Brown, C.M., and Stephenson, A.E., 1991- Geology of the Murray Basin, Southeastern Australia., Bureau of Mineral Resources, Geology and Geophysics, BMR Bulletin 235, (Australian Government Publishing Services, Canberra)

National Environmental Consultancy, 1987- Chowilla Salinity Mitigation Scheme: Draft Environmental Impact Statement, South Australia Engineering and Water Supply,

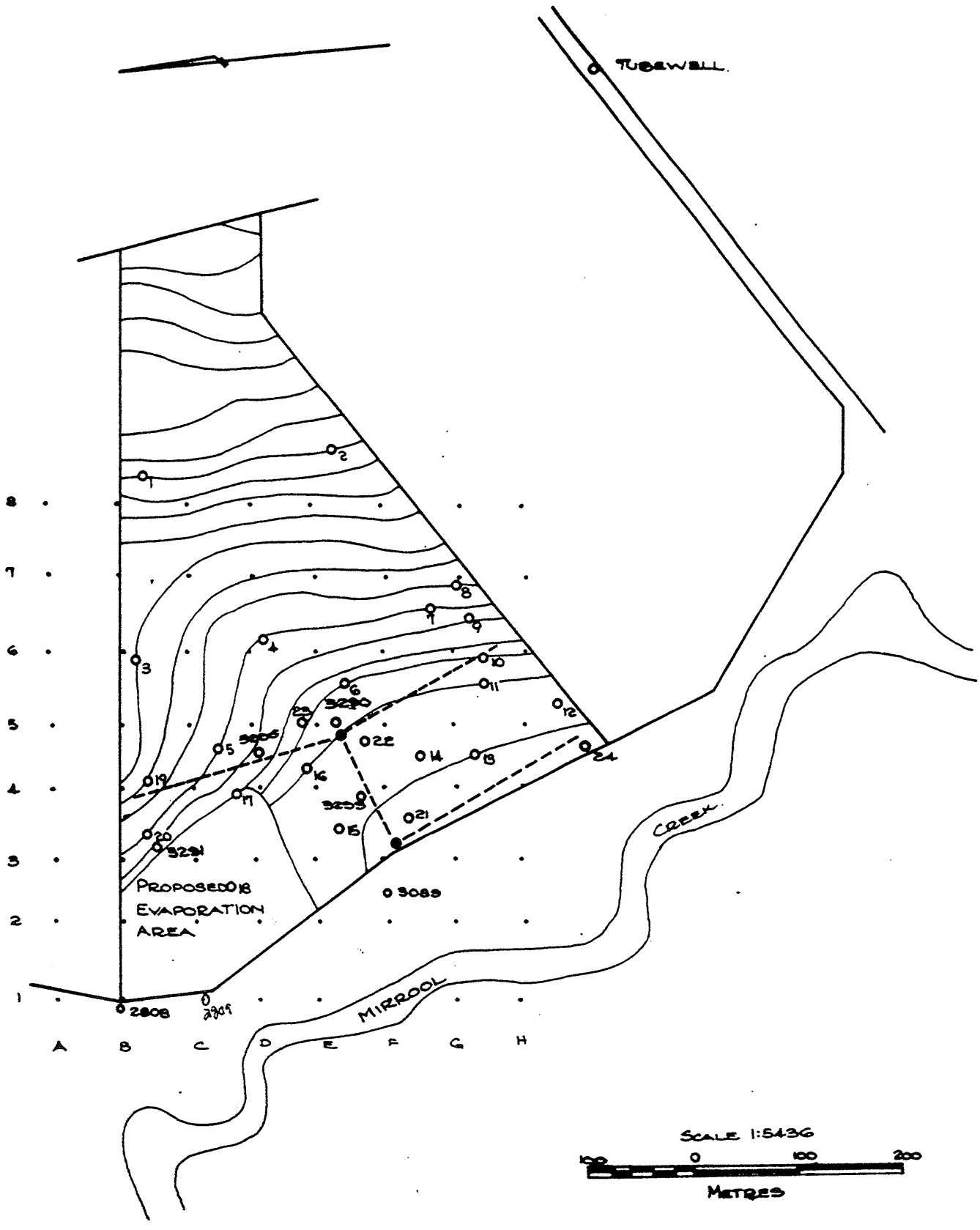
Williams, R.M., 1993- Evaluation of Disposal Basins by Ranking in New South Wales, Department of Water Resources, Technical Services Division, 26 pp.

Woolley, D., (Department of Water Resources, NSW), 1991- Narrandera Hydrogeological Map (1:250,000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Wynn, D.W., 1962- Narrandera- 4 mile Geological Series., The Geological Survey of New South Wales, Sheet I55/10 Zone 7, Australian National Grid.


N
Mirool Farm 1061
Mirool Farm 1068
0
1 km
2 km

Farm 1061



(DWR, Griffith)

<Site Name> Farm 1068
<Synonyms> Mirrool Farm 1068
Fitzsimmons

Spatial

<Location description> 10 kilometres south of Griffith on Darlington Point Road

<Located in Murray Trench> No

<Location 1:250 000> Narrandera

<Location 1:100 000> Griffith 8129

<Zone> 55H

<Coordinates easting (AMG)> 412000

<Coordinates northing (AMG)> 6192000

<State> New South Wales

General

<Year begun operation> 1/5/1984

<Active/inactive> Active

<Full surface area (ha)> 1-2 ha

<Volume capacity (ML)>

<Full surface level (m AHD)>

<Groundwater level (m AHD)> 123.05 to 123.47 m AHD (5/8/84)

<Groundwater seepage/discharge> 1-2 metres (Williams, 1993)

<Average annual evaporation> 1702 mm/yr (CSIRO, Griffith)

<Volume disposed annually (ML/yr)> between 1984 and 1991 2000 tonnes of salt were deposited

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)> 11,700 mg/L TDS (Williams, 1993); 155,000 to 228,000 EC (DWR, Griffith)

<Sources of water to be disposed> Irrigation

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts> Basin practically dry

Engineering/Admin

<Public or private operation> Private

<**Site Name**> Farm 1068
<**Synonyms**> Mirrool Farm 1068
Fitzsimmons

<**Agency responsible**> New South Wales Department of Water Resources

<**Project name**> Mirrool Farm 1068

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**>

Geological

<**Site description and Geomorphology**> The basin is located in a drainage depression 250 metres east of the confluence of Mirrool Creek and Little Mirrool Creek. The northern and southern slopes adjoining the depression are terraced for rice cultivation.

<**Subsurface investigations at site**> 4 DWR bores

<**Structural setting**> The basin is located west of the Griffith Syncline and east of the Griffith? Anticline (Wynn, 1962).

<**Stratigraphic setting**> The basin is floored by the Shepparton Formation (40 m), and underlain by the Calivil Formation (60 m) and the Renmark Group (100 m) (Wynn, 1962).

<**Host formation**> Shepparton Formation

<**Host lithofacies**> Medium clay

<**Aquitard**> Shepparton Formation

<**Aquitard lithofacies**> Medium clay

<**Aquifer**> Shepparton Formation, Calivil Formation, and Renmark Group

<**Aquifer lithofacies**> Shepparton Formation: Fine to coarse sand in shoestring sand bodies (prior streams), Calivil Formation: Poorly sorted gravel, coarse sand, and some clay (kaolin), Renmark Group: Carbonaceous silt, siltstone, sand, clay, and lignite (Brown and Stephenson, 1991).

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> Does not drain into the Murray River

<**Head between basin and river/tributary**>

<**Direction of groundwater flow in regional aquifer**> WNW (Woolley, 1991)

<**kv of artificial floor**>

<**kv and kh of host**> Shepparton Formation: Kv $<3 \times 10^{-3}$ m/day (DWR bore logs, and L. Ellis, pers. comm.)

<Site Name> Farm 1068
<Synonyms> Mirrool Farm 1068
Fitzsimmons

<**kv and kh of aquitard**> Shepparton Formation: Kv <3 x 10^{-3} m/day (DWR bore logs, and L. Ellis, pers. comm)

<**Thickness of aquitard**> Variable

<**kv and kh of aquifer**> Shepparton Formation: Transmissivity = 106.7 m^2/day (DWR bore 3090, Griffith)

<**EC of aquifer**> Shepparton Formation: 9750 mg/L TDS (Williams, 1993)

<**Porosity of aquifer**>

<**Thickness of aquifer**> Shepparton Formation: Variable depending on presence of prior streams; Calivil Formation: 60 metres; Renmark Group: 100 metres.

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> The potentiometric surface in the Shepparton Formation is from 0 to 0.35 metres below the bottom of the basin. The higher watertable presumably coincides with flooding of the basin during disposal (3-4 months per year), while the low level corresponds to when the basin is dry (most of the year). The effect of the leakage should be quite low due to the low salinity of the drainage disposal (2,000-3,000 EC), the small area drained (1 farm), the short period of disposal, and the low hydraulic head. The high salinities in the basin (155,000 to 228,000 EC) is the result of the basin drying out between rice harvests and is not indicative of full conditions.

Water that does enter the Shepparton Formation will flow towards Barren Box Swamp, a regional catchment. From there, water can enter the Calivil Formation and the Renmark Group (and thus the Murray Basin) due to the higher head within the Shepparton (Woolley, 1991). Salinities involved, are in a basin wide perspective low (3000-7000 EC), but it is estimated that the Griffith Area provides about 16.9 EC at Morgan (Annual cost at border 1.3 million dollars (National Environmental Consultancy, 1987)).

<**Hydraulic linkage to surface runoff**> Overflow or disposal into Mirrool Creek flows into Barren Box Swamp, an isolated catchment area with no surface connection to the Murrumbidgee River. Water is held in Barren Box Swamp until it is able to infiltrate into the Renmark Group aquifer.

<**Category - hydraulic stability**>

<**Category - degree of hydraulic isolation**>

<**Evaporation surplus**>

<Site Name> Farm 1068
<Synonyms> Mirrool Farm 1068
Fitzsimmons

nterpretive 2

<Ranking of sustainability>

References Cited

Brown, C.M., and Stephenson, A.E., 1991- Geology of the Murray Basin, Southeastern Australia., Bureau of Mineral Resources, Geology and Geophysics, BMR Bulletin 235, (Australian Government Publishing Services, Canberra)

National Environmental Consultancy, 1987- Chowilla Salinity Mitigation Scheme: Draft Environmental Impact Statement, South Australia Engineering and Water Supply,

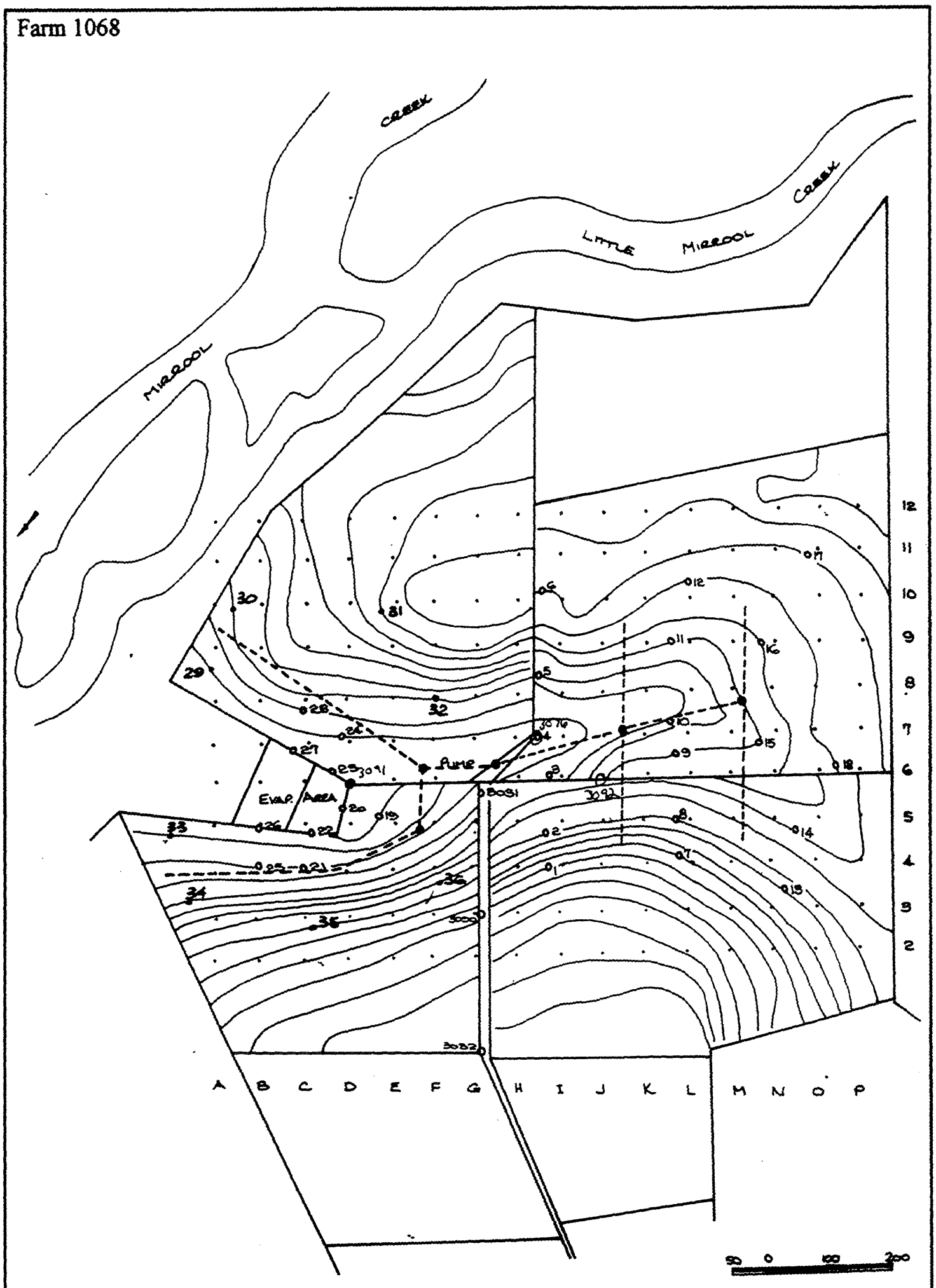
Williams, R.M., 1993- Evaluation of Disposal Basins by Ranking in New South Wales, Department of Water Resources, Technical Services Division, 26 pp.

Woolley, D., (Department of Water Resources, NSW), 1991- Narrandera Hydrogeological Map (1:250,000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Wynn, D.W., 1962- Narrandera- 4 mile Geological Series., The Geological Survey of New South Wales, Sheet I55/10 Zone 7, Australian National Grid.


N
Mirool Farm 1061
Mirool Farm 1068
0
1 km
2 km

Farm 1068



(DWR, Griffith)

<Site Name> Farm 1393
<Synonyms> Mirrool Farm 1393
Bilbul

Spatial

<Location description> 1 kilometre south of Bilbul, NSW and 7 kilometres east of Griffith, NSW

<Located in Murray Trench> No

<Location 1:250 000> Narrandera

<Location 1:100 000> Griffith 8129

<Zone> 55H

<Coordinates easting (AMG)> 420500

<Coordinates northing (AMG)> 6205650

<State> New South Wales

General

<Year begun operation>

<Active/inactive> Active

<Full surface area (ha)>

<Volume capacity (ML)>

<Full surface level (m AHD)>

<Groundwater level (m AHD)> 120.59 to 120.81 m AHD (1/87)

<Groundwater seepage/discharge> Seepage

<Average annual evaporation> 1702 mm/yr (CSIRO, Griffith)

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)>

<Sources of water to be disposed> Onsite tile drainage from the farm

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base>

<Review of environmental impacts> Basin practically dry

Engineering/Admin

<Public or private operation> Private

<Agency responsible> Department of Water Resources

<Site Name> Farm 1393
<Synonyms> Mirrool Farm 1393
Bilbul

<Project name> Farm 1061

<Natural, modified natural or constructed> Modified natural

<Modification type and degree>

Geological

<Site description and Geomorphology> The basin is the terminal of a laser level field just south of the Main Drain.

<Subsurface investigations at site>

<Structural setting> The basin is located west of the Griffith Syncline and east of the Griffith? Anticline (Wynn, 1962).

<Stratigraphic setting> The basin is floored by the Shepparton Formation (40 m), and underlain by the Calivil Formation (60 m) and the Renmark Group (100 m) (Woolley, 1991).

<Host formation> Shepparton Formation

<Host lithofacies> Medium clay to heavy clay (DWR piezometer logs, Griffith)

<Aquitard> Shepparton Formation

<Aquitard lithofacies> Medium clay to heavy clay (DWR piezometer logs, Griffith)

<Aquifer> Shepparton Formation, Calivil Formation, Renmark Group

<Aquifer lithofacies> Shepparton Formation: Fine to coarse sand in shoestring sand bodies (prior streams), Calivil Formation: Poorly sorted gravel, coarse sand, and some clay (kaolin), Renmark Group: Carbonaceous silt, siltstone, sand, clay, and lignite (Brown and Stephenson, 1991)

<Comments>

Summary of Hydrodynamics

<Distance to Murray or tributary> Surface drainage goes into an isolated catchment system (Barren Box Swamp), and is only connected to the River Murray by the Renmark Group aquifer.

<Head between basin and river/tributary> <0.5 metre

<Direction of groundwater flow in regional aquifer> WSW (Woolley, 1991)

<kv of artificial floor>

<kv and kh of host> Shepparton Formation: Kv $<3 \times 10^{-3}$ m/day (DWR bore logs, and L. Ellis, pers. comm.)

<kv and kh of aquitard> Shepparton Formation: Kv $<3 \times 10^{-3}$ m/day (DWR bore logs, and L. Ellis, pers. comm.)

<Thickness of aquitard> Variable depending on the thickness and presence of the shoestring

<Site Name> Farm 1393
<Synonyms> Mirrool Farm 1393
Bilbul

sand bodies

<kv and kh of aquifer> Calivil Formation: Kv = 0.3 m/day, Kh = 30-40 m/day (J. Kellet, pers. comm.); Shepparton Formation: Transmissivity = 56.5 m^2/day (DWR bore 3295, Griffith)

<EC of aquifer> Shepparton Formation: 9750 mg/L TDS (Williams, 1993); Calivil Formation: 1000-1500 mg/L; Renmark Group: < 500 mg/L (Woolley, 1991); Shepparton Formation (prior stream sand): 18,200 EC (DWR bore 3295, Griffith)

<Porosity of aquifer>

<Thickness of aquifer> Shepparton Formation: Variable depending on presence or absence of shoestring sand bodies; Calivil Formation: 60 metres; Renmark Group: 100 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The potentiometric surface in the Shepparton Formation is 0 to 0.30 metres below the bottom of the basin. The higher watertable presumably coincides with flooding of the basin during disposal (3-4 months per year), while the low level corresponds to when the basin is dry (most of the year). The effect of the leakage should be quite low due to the low salinity of the drainage disposal (2,000-3,000 EC), the small area drained (1 farm), the short period of disposal, and the low hydraulic head.

Water that does enter the Shepparton Formation will flow towards Barren Box Swamp, a regional catchment. From there, water can enter the Calivil Formation and the Renmark Group (and thus the Murray Basin) due to the higher head within the Shepparton (Woolley, 1991). Salinities involved, are in a basin wide perspective low (3000-7000 EC), but it is estimated that the Griffith Area provides about 16.9 EC at Morgan (Annual cost at border 1.3 million dollars (National Environmental Consultancy, 1987)).

<Hydraulic linkage to surface runoff> Overflow or disposal into Main Drain? which flows into Mirrool Creek and eventually Barren Box Swamp, an isolated catchment area with no surface connection to the Murrumbidgee River. Water is held in Barren Box Swamp until it is able to infiltrate into the Renmark Group aquifer.

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

<Site Name> Farm 1393
<Synonyms> Mirrool Farm 1393
Bilbul

References Cited

Brown, C.M., and Stephenson, A.E., 1991- Geology of the Murray Basin, Southeastern Australia., Bureau of Mineral Resources, Geology and Geophysics, BMR Bulletin 235, (Australian Government Publishing Services, Canberra)

National Environmental Consultancy, 1987- Chowilla Salinity Mitigation Scheme: Draft Environmental Impact Statement, South Australia Engineering and Water Supply,

Williams, R.M., 1993- Evaluation of Disposal Basins by Ranking in New South Wales, Department of Water Resources, Technical Services Division, 26 pp.

Woolley, D., (Department of Water Resources, NSW), 1991- Narrandera Hydrogeological Map (1:250,000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Wynn, D.W., 1962- Narrandera- 4 mile Geological Series., The Geological Survey of New South Wales, Sheet I55/10 Zone 7, Australian National Grid.


Mirrool Farm 1393
0
1 Km
2 Km
(0/11/1968)

<Site Name> Farm 1810
<**Synonyms**> Sergi

Spatial

<**Location description**> 6 kilometres west of Griffith, NSW and 12 kilometres southeast of Barren Box Swamp

<**Located in Murray Trench**> No

<**Location 1:250 000**> Narrandera

<**Location 1:100 000**> Kooroongal 8029

<**Zone**> 55H

<**Coordinates easting (AMG)**> 403800

<**Coordinates northing (AMG)**> 6208800

<**State**> New South Wales

General

<**Year begun operation**> 1990

<**Active/inactive**> Active

<**Full surface area (ha)**> Portion 157 = 3.237 ha

<**Volume capacity (ML)**> Portion 157 = 7 ML, Portion 150 &151 = 10 ML

<**Full surface level (m AHD)**> 103.56 m AHD

<**Groundwater level (m AHD)**> 99.55 m AHD

<**Groundwater seepage/discharge**>

<**Average annual evaporation**> 1702 mm/yr (CSIRO, Griffith)

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**>

<**Sources of water to be disposed**> Tile drains

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**> 0.5 metre

<**Lining/treatment of base**> The inner surface has a 150 mm layer of clay on walls only, and 1 metre of additional subsoil.

<**Review of environmental impacts**> Designed to be self contained, but with recent over pumping the owner has had to get DWR to remove saline water.

<Site Name> Farm 1810
<Synonyms> Sergi

Engineering/Admin

<**Public or private operation**> Private

<**Agency responsible**> Tony Sergi

<**Project name**> Farm 1810

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> 0.75 metre banks

Geological

<**Site description and Geomorphology**> The basin is located within the highly developed agricultural region of Griffith. The dominant topography consists of low lying hills and valleys of the Shepparton Formation.

<**Subsurface investigations at site**> 2 bores and an array of piezometers

<**Structural setting**> East of the McPhersons Range Anticline and west of the Cocoparra Syncline (Wynn, 1962)

<**Stratigraphic setting**> The basin is floored by the Shepparton Formation (40 m), and underlain by the Calivil Formation (60 m) and the Renmark Group (100 m) (Wynn, 1962).

<**Host formation**> Shepparton Formation

<**Host lithofacies**> Clayey loam and light to medium clay (Bore 458, DWR, Griffith)

<**Aquitard**> Shepparton Formation

<**Aquitard lithofacies**> Clayey loam and light to medium clay (Bore 458, DWR, Griffith)

<**Aquifer**> Shepparton Formation, Calivil Formation, and Renmark Group

<**Aquifer lithofacies**> Shepparton Formation: Fine to coarse sand (Bore 458, DWR, Griffith); Calivil Formation: Poorly sorted gravel, coarse sand, and some clay (kaolin), Owing to the closeness to the edge of the basin the Calivil Formation is probably very coarse and poorly sorted, Renmark Group: Carbonaceous silt, siltstone, sand, clay, and lignite (Brown and Stephenson, 1991)

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> Only connected to the Murray River by the Renmark Group, no surface hydraulic connection.

<**Head between basin and river/tributary**>

<**Direction of groundwater flow in regional aquifer**> Southwest (Woolley, 1991)

<Site Name> Farm 1810
<Synonyms> Sergi

<kv of artificial floor>

<kv and kh of host> Shepparton Formation: Kv = 0.3 m/day (Bore 458, L. Ellis, pers. comm.)

<kv and kh of aquitard> Shepparton Formation: Kv = 0.3 m/day (Bore 458, L. Ellis, pers. comm.)

<Thickness of aquitard> Thickness is variable depending on the internal geometry of the Shepparton Formation.

<kv and kh of aquifer> Calivil Formation: Kv = 0.3 m/day, Kh = 30-40 m/day (J. Kellet, pers. comm.)

<EC of aquifer> Shepparton Formation: 9750 mg/L TDS (Williams, 1993); Calivil Formation: 1000-1500 mg/L; Renmark Group: < 500 mg/L (Woolley, 1991)

<Porosity of aquifer>

<Thickness of aquifer> Shepparton Formation thickness is variable depending on the presence or absence of prior stream sands; Calivil Formation: 60 metres; Renmark Group: 100 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Water that enters the Shepparton Formation will flow towards Barren Box Swamp, a regional catchment. From there, water can enter the Calivil Formation and the Renmark Group (and thus the Murray Basin) due to the higher head within the Shepparton (Woolley, 1991). Salinities involved, are in a basin wide perspective low (3000-7000 EC), but it is estimated that the Griffith Area provides about 16.9 EC at Morgan (Annual cost at border 1.3 million dollars (National Environmental Consultancy, 1987)).

<Hydraulic linkage to surface runoff> Overflow or disposal into Mirrool Creek flows into Barren Box Swamp, an isolated catchment area with no surface connection to the Murrumbidgee River. Water is held in Barren Box Swamp until it is able to infiltrate into the Renmark Group aquifer.

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

<Site Name> Farm 1810
<Synonyms> Sergi

Interpretive 2

<Ranking of sustainability>

References Cited

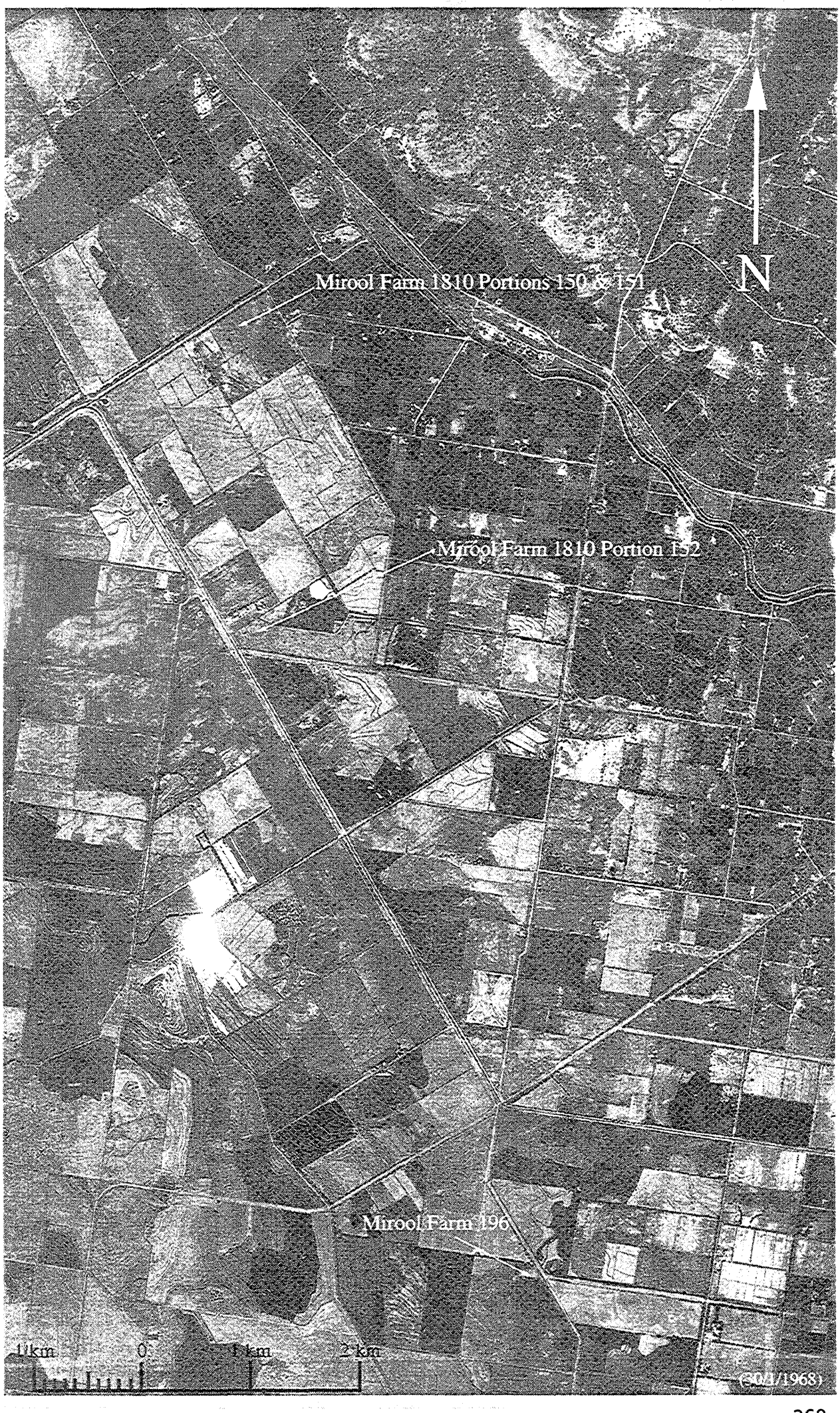
Brown, C.M., and Stephenson, A.E., 1991- Geology of the Murray Basin, Southeastern Australia., Bureau of Mineral Resources, Geology and Geophysics, BMR Bulletin 235, (Australian Government Publishing Services, Canberra)

National Environmental Consultancy, 1987- Chowilla Salinity Mitigation Scheme: Draft Environmental Impact Statement, South Australia Engineering and Water Supply

Williams, R.M., 1993- Evaluation of Disposal Basins by Ranking in New South Wales, Department of Water Resources, Technical Services Division, 26 pp.

Woolley, D., (Department of Water Resources, NSW), 1991- Narrandera Hydrogeological Map (1:250,000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Wynn, D.W., 1962- Narrandera- 4 mile Geological Series., The Geological Survey of New South Wales, Sheet I55/10 Zone 7, Australian National Grid.


Mirool Farm 1810 Portions 150 & 151
N
Mirool Farm 1810 Portion 152
Mirool Farm 196
1/km
0
1 km
2 km
(30/1/1968)

<Site Name> Mourquong Swamp
<Synonyms>

Spatial

<**Location description**> Due north of Mildura, NSW; 4-8 kilometres north River Murray; Adjacent and north of Stanley Wines vineyard on Buronga-Dareton highway

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 60800

<**Coordinates northing (AMG)**> 622600

<**State**> New South Wales

General

<**Year begun operation**> 1979

<**Active/inactive**> Active

<**Full surface area (ha)**> 324 ha; 150 ha of swamp in 1989

<**Volume capacity (ML)**> 900 ML

<**Full surface level (m AHD)**>

<**Groundwater level (m AHD)**> 31-33 metres AHD, 32 m AHD in 1989

<**Groundwater seepage/discharge**>

<**Average annual evaporation**> Pan evaporation: 2200 mm/yr

<**Volume disposed annually (ML/yr)**> 4380 ML/yr

<**Salinity of water disposed (EC)**> 22,800 mg/L TDS (100,000 tonnes salt annually)

<**Range of salinity in basin (EC)**> 97 500 mg/L TDS (Williams, 1993), 150,000 EC in 1989

<**Sources of water to be disposed**> Groundwater seepage to Murray River downstream of Mildura Weir

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**> Has been used for gypsum mining. Presently unsure of recharge rates to groundwater mound. Unsure of possible Shepparton-Coonambidgal aquifer linkage back to Murray River. It is currently thought that 3/4 of salt is recharged to groundwater (Ferguson, pers. comm.).

<Site Name> Mourquong Swamp
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> New South Wales Department of Water Resources (Dareton)

<**Project name**> Mourquong/ Buronga Salt Interception Scheme

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> Semicircular topographic depression 10 kilometres in diameter with the eastern, northern, and southern margins delineated by a crescentic dune complex, which is part of a fossil stranded lake deposit on the upper Blanchetown Formation. The western margin, is a slope down from the ridge and an active salina. In the outermost circular dunes is a complex topography of flat topped gypsum terraced pedestals, with lunette accretion on the W and NW. Longitudinal Woorinen Formation dunes overlie the sandy ridge to the west, although there are no dunes within the complex (Radke, 1993).

<**Subsurface investigations at site**> AGSO drilling and piezometers

<**Structural setting**> The basin is located on the western edge and adjacent to the Danyo Fault (N-NE strike), which separates the underlying Koorlong Trough and low ridge to the west corresponding to the structural Merbein Ridge (Radke, 1993).

<**Stratigraphic setting**> The basin is floored by the Yamba Formation (1-2 m), surrounded by the Woorinen Formation (5 m), and underlain by the Shepparton Formation and Blanchetown Clay (which interdigitate and overly each other) (2-5 m), the Parilla Sand (80 m), the Bookpurnong Beds, and Renmark Group (Geology interpreted from Radke, 1993).

<**Host formation**> Yamba Formation

<**Host lithofacies**> Gypsum sand beds and laminae, interlaminated with clay and muds, also contains brown quartz sand (Woorinen derived) intervals.

<**Aquitard**> Blanchetown Clay and Shepparton Formation

<**Aquitard lithofacies**> Blanchetown Clay: Lower 1.2 metre intermixture of Parilla Sand and Blanchetown mud in thin-bedded sand-mud layers. Where unweathered, upper portion is bluish-grey mud and clay with stratiform gypseous mud and interbedded carbonates

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Semiconsolidated light olive grey, variably sorted to bimodal quartz sand. Top portion has colour mottling corresponding to an increase in clay content filtering from the Blanchetown Clay. There is also evidence of bioturbation at the Blanchetown contact.

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 3 kilometres

<Site Name> Mourquong Swamp
<Synonyms>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer>Preferential flow north and east, rather than towards the Murray River due to greater transmissivity, aquifer thickness, and the groundwater mound beneath the Coomealla Irrigation Area. Also a component of flow SSW towards the Murray River (Scott, William, & Erny, 1991). In the southern end of the swamp the recharge is split with half going northeast with a salinity of 300,000 EC, and half going south with a salinity of 60,000 EC (Van der Lelij and Erny, 1989).

<kv of artificial floor> N/A

<kv and kh of host>

<kv and kh of aquitard> (Porosity <2%)

<Thickness of aquitard> Blanchetown Clay: 2-5 metres

<kv and kh of aquifer> Parilla Sand: Transmissivity = 500 m^2/day (Pump tests, 1979; Merrick, 1987)

<EC of aquifer> Yamba Formation: 130,000-150,000 EC; Blanchetown Clay: 40,000-120,000 EC Parilla Sand: 50,000-70,000 EC All figures prior to flooding; 39 000 mg/L TDS (Williams, 1993)

<Porosity of aquifer> Parilla Sand: 20-30%

<Thickness of aquifer> Parilla Sand: 80 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Mourquong Swamp has been an historically active depocentre and discharge site since the deposition of the Blanchetown Clay and the Yamba Formation. It presently receives discharge from the Parilla Sand (through sandy layers of the Blanchetown Clay too), and possibly the perched aquifer within the Woorinen Formation due to recharge from the groundwater mound beneath Buronga (and possibly flow under the river from beneath Mildura) and from seepage in Holland Lake 1 (Linke, 1990b). Discharge is mainly along the northwest and southeast margins of the basin through the sandier layers of the Blanchetown Clay and into the Yamba Formation, which then allows surface transport and collection in the centre of the basin (Ferguson, unpublished). Seepage from the basin is split into flow to the northeast in the Parilla Sand at 0.75 m/day, which will eventually turn to the west and recharge in the Darling Anabranch, and to the southwest which will enter the Murray River near Buronga at 1.5 m/day (Van der Lelij and Erny, 1989). The actual dynamics are complicated by the interaction of the different brines, evaporation, permeability differences, and the introduction of disposal water which combine to produce a real system.

<Hydraulic linkage to surface runoff> Possibly through Shepparton Formation facies within complex. This facies locally overlies eroded surface of Blanchetown Clay.

<Category - hydraulic stability>

<Site Name> Mourquong Swamp
<Synonyms>

<Category - degree of hydraulic isolation> Questionable

<Evaporation surplus> Inflow/Evaporation 0.5/0.8 (Williams, 1993)

Interpretive 2

<Ranking of sustainability>

References Cited

Merricks, 1987??

Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

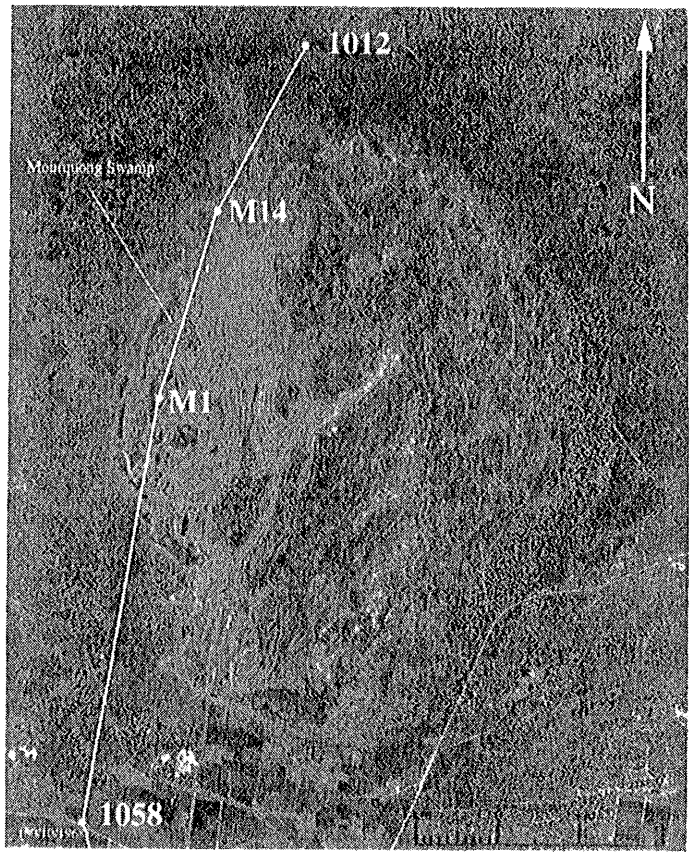
Radke, B.M., 1993- Physiographic and lithostratigraphic interpretation of the Nulla, Mourquong, and Scotia Groundwater Discharge Complexes, Mallee Region, Murray Basin, Southeastern Australia. (Unpbl.). CSIRO-AGSO project;Groundwater dynamics of evaporative brines and their application to saline wastewater disposal.

Scott, D.I., Williams, R.M., and Erny, M., 1991- Coomealla Irrigation Area pipeline Proposal: A review of the regional groundwater. Department of Water Resources, Technical Unit, 42 p.

Van der Lelij, A., and Erny, M., 1989- Effect of disposal lakes on groundwater conditions, lower Murray Darling Region-Discussion paper, New South Wales Department of Water Resources Technical Report 89/022.

Williams, R.M., 1993- Evaluation of Disposal Basins by Ranking in New South Wales, Department of Water Resources, Technical Services Division, 26 pp.


Mourquong Swamp
N
(30/10/1968)



Mourquong Swamp

V/H 70

N

S

1012

M14

M1

1058

1057

1056

Woorinen Formation

Yamba Formation

Blanchetown Clay

Parilla Sand

Parilla Sand

Elevation (AHD)

60

50

40

30

20

10

0

1000

2000

3000

4000

5000

6000

7000

8000

9000

10000

275

<Site Name> Nulla Discharge Complex
<Synonyms> Nulla Spring Complex

Spatial

<Location description> 10 kilometres NNE of Nanya Homestead and 140 kilometres NW of Mildura.

<Located in Murray Trench> No

<Location 1:250 000> Ana Branch

<Location 1:100 000> Scotia 7131

<Zone> 54H

<Coordinates easting (AMG)> WJ 34 34

<Coordinates northing (AMG)>

<State> New South Wales

General

<Year begun operation>

<Active/inactive>

<Full surface area (ha)>

<Volume capacity (ML)>

<Full surface level (m AHD)> 20.3-21 metres AHD

<Groundwater level (m AHD)>

<Groundwater seepage/discharge>

<Average annual evaporation>

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)>

<Minimum salinity in basin (EC)>

<Sources of water to be disposed>

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base>

<Review of environmental impacts>

<Site Name> Nulla Discharge Complex
<Synonyms> Nulla Spring Complex

Engineering/Admin

<Public or private operation>

<Agency responsible>

<Project name> Nulla Discharge Complex

<Natural, modified natural or constructed>

<Modification type and degree>

Geological

<Site description and Geomorphology> The Nulla Complex is located within a small, broad, shallow, closed topographic depression which extends approximately 13 kilometres north-south, and 10 kilometres east-west. Active salinas occupy small areas in the lowest part of the complex and are entrenched in a fossil stranded lake complex. Adjacent lunette ridges which form low sinuous bordering ridges hundreds of metres long, 30-40 metres wide, and 2-3 metres high. Inactive areas are delineated by sequences of older lunettes.

<Subsurface investigations at site>

<Structural setting>

<Stratigraphic setting> The basin is floored by the Yamba Formation (2-3 m), and is underlain by the Bungunnia Limestone (m), the Blanchetown Clay (10 m), and the Parilla Sand (80 m).

<Host formation> Yamba Formation

<Host lithofacies> Lunette and salt deposits

<Aquitard> Blanchetown Clay

<Aquitard lithofacies> Grey clay

<Aquifer> Parilla Sand

<Aquifer lithofacies> Fine to medium quartz sand

<Comments>

Summary of Hydrodynamics

<Distance to Murray or tributary> 13 kilometres to Lake Victoria

<Site Name> Nulla Discharge Complex
<Synonyms> Nulla Spring Complex

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> WSW

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Blanchetown Clay: 10 metres (Brodie, 1992)

<kv and kh of aquifer> 3 m/day (Brodie, 1992)

<EC of aquifer> 75,000 mg/L (Brodie, 1992)

<Porosity of aquifer>

<Thickness of aquifer> 50 metres (Brodie, 1992)

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer>

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Site Name> Nulla Discharge Complex
<Synonyms> Nulla Spring Complex

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Brodie, R., (AGSO), 1992- ANA BRANCH Hydrogeological Map (1:250 000 scale). Australian Geological Survey Organisation, Canberra, Australia.

Radke, B.M., 1993- Physiographic and lithostratigraphic interpretation of the Nulla, Mourquong, and Scotia Groundwater Discharge Complexes, Mallee Region, Murray Basin, Southeastern Australia. (Unpbl.). CSIRO-AGSO project;Groundwater dynamics of evaporative brines and their application to saline wastewater disposal.

<Site Name> Scotia Lakes Discharge Complex
<Synonyms>

Spatial

<Location description>

<Located in Murray Trench> No

<Location 1:250 000> Anabranch

<Location 1:100 000> Scotia 7131

<Zone> 54

<Coordinates easting (AMG)> 533000

<Coordinates northing (AMG)> 6334000

<State> New South Wales

General

<Year begun operation>

<Active/inactive>

<Full surface area (ha)>

<Volume capacity (ML)>

<Full surface level (m AHD)>

<Groundwater level (m AHD)>

<Groundwater seepage/discharge>

<Average annual evaporation>

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)>

<Minimum salinity in basin (EC)>

<Sources of water to be disposed>

<Terminal/throughflow basin>

<Range of elevation of lake surface with disposal>

<Lining/treatment of base>

<Review of environmental impacts>

<Site Name> Scotia Lakes Discharge Complex
<Synonyms>

Engineering/Admin

<Public or private operation>

<Agency responsible>

<Project name>

<Natural, modified natural or constructed> Natural

<Modification type and degree>

Geological

<Site description and Geomorphology> Flat to slightly undulose terrain covered with a well established Woorinen Dune Field. The dunes form a steep slope on the western margin of the complex and resume again on the east. The lake system is located in a boinka with a complex of lunette and lacustrine deposits.

<Subsurface investigations at site> Hydrocarbon exploration was carried out by Claremont Petroleum N.L. drilling several stratigraphic holes

<Structural setting> Overlies a dome or anticlinal structure, in an exhumed area of the Geera Clay equivalent, the complex also lies just to the northwest of, and on the upthrown side of the southwest-northeast trending Hamley Fault. The uplift has warped the Parilla Sands and has removed the overlying aquiclude, allowing the site to become a natural discharge zone (Radke, 1993).

<Stratigraphic setting> The Scotia Complex is underlain by the Geera Clay (5-10 metres), a thick muddy aquitard. It is locally overlain in the northern and western margin of the lake (Ironstone and Alluvial Lake) and in isolated inliers within the lake by the Parilla Sand. The Parilla consists of two lithologies, an unconsolidated, uniform, medium quartz sand, and an unconsolidated bimodal fine to medium sand. Locally the lake is underlain by the Yamba Formation or equivalent and consists of lacustrine and lunette deposits. Overlying the regional Parilla Sands, is the Woorinen Formation (25 metres).

<Host formation> Yamba Formation

<Host lithofacies> A complex of lenses and tabular beds consisting of six units. Unit 1, is 6.5 metres thick, tabular bed consisting of unconsolidated light brown, speckled, very fine to fine grained, quartz sand that are locally cross stratified and calcareous. There is also lower light brown to medium brown plastic clays that are displaced by gypsum at the top of the section. Unit 2, is a lens in a structural depression about 50 centimetres thick. It consists of a semi-indurated millimetre sized lumps of siltstone and unconsolidated quartz sand. Unit 3, is a widespread blanket, approximately 4.5 metes thick. It consists of uniformally unconsolidated light olive grey to dusky yellow quartz sand. Unit 4, is a tabular bed about 3 metes thick that pinches out towards the basin margin. It consists of alternating layers of sands, laminated muds, and clays. Unit 5, is an 1.5 metres thick almost tabular bed, that thins out towards the west. It consists of alternating layers of sand and clay. Unit 6, is a veneer of lunettes, consisting of friable grapestone, gypseous to calcareous to dolomitic. (Radke, 1993)

<Aquitard> Geera Clay

<Site Name> Scotia Lakes Discharge Complex
<Synonyms>

<Aquitard lithofacies> The Geera Clay is approximately 10 metres thick. The lower 5.3 metres consists of a black plastic clay with pyritized plant and carbonaceous wood fragments, the upper 3 metres is a brownish black clay with pyritized plant remains and numerous thin flaser-like silty sand interlaminations. The upper surface of the Geera Clay where exposed is deeply weathered which increases to the south (Radke, 1993)

<Aquifer> Parilla Sands

<Aquifer lithofacies> Surface expression is an indurated cross-stratified set of limonitic sandstone, that forms prominent dark brown limonitic terraces. Its position along the margins, and as pedestals seems to indicate the extent of the proto-Scotia lake (Radke, 1993).

<Comments> Due to the up warping of the area, the Parilla is eroded down to the Geera Clay. It still exists as pedestals within the complex, and on the outer edges of the drainage basin. There is also an underlying Palaeozoic fabric (Hamely Fault) which influences the structure and thickness of the lacustrine deposits. The Parilla is unconfined, with its discharge and deflation being controlled by the Geera structure.

Summary of Hydrodynamics

<Distance to Murray or tributary>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer>

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard>

<kv and kh of aquifer>

<EC of aquifer>

<Porosity of aquifer>

<Thickness of aquifer>

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

<**Site Name**> Scotia Lakes Discharge Complex
<**Synonyms**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> Parilla Sands and Renmark aquifer (Regional) share a common recharge area, but are not thought to be hydraulically linked (Radke, 1993).

<**Hydraulic linkage to surface runoff**>

<**Category - hydraulic stability**>

<**Category - degree of hydraulic isolation**>

<**Evaporation surplus**>

Interpretive 2

<**Ranking of sustainability**>

References Cited

Radke, B.M., 1993- Physiographic and lithostratigraphic interpretation of the Nulla, Mourquong, and Scotia Groundwater Discharge Complexes, Mallee Region, Murray Basin, Southeastern Australia. (Unpbl.). CSIRO-AGSO project;Groundwater dynamics of evaporative brines and their application to saline wastewater disposal.

<Site Name> Wakool Evaporation Basin
<Synonyms>

Spatial

<**Location description**> Two stages, Stage 1, 5 kilometres NW of Stage 2. Stage 2, 2 kilometres NW of Wakool at NW corner of the Tullakool Irrigation Area.

<**Located in Murray Trench**> No

<**Location 1:250 000**> Deniliquin

<**Location 1:100 000**> Moulamein

<**Zone**> 55

<**Coordinates easting (AMG)**> Stage 1 = 245000; Stage 2 = 242000

<**Coordinates northing (AMG)**> Stage 1 = 6083000; Stage 2 = 6086000

<**State**> New South Wales

General

<**Year begun operation**> 1981

<**Active/inactive**> Active

<**Full surface area (ha)**> 2120 ha

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> Stage 1: 0-1.5 metres below surface. Stage 2: 0.5-2.0 metres below surface

<**Groundwater level (m AHD)**> 72 m AHD

<**Groundwater seepage/discharge**>

<**Average annual evaporation**> 1584 mm/yr

<**Volume disposed annually (ML/yr)**> 100,000 ML since 1979

<**Salinity of water disposed (EC)**> 0-750,000 EC, average 20,000 EC

<**Minimum salinity in basin (EC)**> 29,055 mg/L TDS (Williams, 1993); 750,000 EC

<**Sources of water to be disposed**> Saline groundwater

<**Terminal/throughflow basin**> Terminal evaporation basin

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**>

<**Review of environmental impacts**> Irrigation since 1936, combined with inadequate drainage has raised the watertable. The problem has also been exacerbated by upward leakage from the underlying Calivil and Renmark aquifers into flat terrain with meandering prior streams. 1983- 30,000 ha with shallow watertable and 3-4,000 ha visibly salinised.

Cheetham Salt Ltd has the contract for harvesting salt at Wakool, however it is considered to be not of good quality. There is some harvesting of bitterns in Stage 1 (B. Percival, pers. comm.).

<**Site Name**> Wakool Evaporation Basin
<**Synonyms**>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> New South Wales Department of Water Resources (Irrigators privatised)

<**Project name**> Wakool Tullakool Subsurface Drainage Scheme (WTSSDS)

<**Natural, modified natural or constructed**> Constructed

<**Modification type and degree**>

Geological

<**Site description and Geomorphology**> The basin is divided into two stages, and up to 30 sub-basins per stage. It is surrounded by rice paddies and is bounded on the north by Jimaringle Creek and on the south by the Wakool River.

<**Subsurface investigations at site**> 1300 bores, 55 pumps running

<**Structural setting**> The basin is east of the Leaghur Fault and west of the Cadell Fault (Brown and Stephenson, 1991).

<**Stratigraphic setting**> The basin is floored by the Shepparton Formation (40 m), and underlain by the Parilla Sand (10 m), the Calivil Formation (60 m), and the Renmark Group (230 m) (Brown and Stephenson, 1991).

<**Host formation**> Shepparton Formation

<**Host lithofacies**> Medium clay to heavy clay, also some sand in prior streams

<**Aquitard**> Shepparton Formation

<**Aquitard lithofacies**> Medium clay to heavy clay

<**Aquifer**> Shepparton Formation, Parilla Sand and Calivil Formation, Renmark Group

<**Aquifer lithofacies**> Shepparton Formation: Around Wakool, the Shepparton Formation contains numerous shoe-string sand bodies that generally trend NW-SE. Beneath Wakool, depth to the prior streams ranges from 3-10 metres and consists of fine to coarse sand.; Parilla Sand and Calivil Formation: Uncemented medium to fine grained quartz sand, and poorly consolidated coarse sand and granular sand conglomerate with kaolinitic matrix, and some carbonaceous layers; Renmark Group: Unconsolidated to poorly consolidated thinly bedded, dark brown to carbonaceous sand, silt, clay, and lignite (Williams and Woolley. 1992)

<**Comments**> The area is roughly on the boundary of the Calivil Formation and the Parilla Sand. However, because of the high permeability of each formation, they act as one aquifer (Pliocene Sand Aquifer).

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 3 kilometres to Jimaringle Creek

<Site Name> Wakool Evaporation Basin
<Synonyms>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Northwest flowlines go around Wakool because of the groundwater mound associated with the basin.

<kv of artificial floor>

<kv and kh of host> Very variable, depending on the presence or absence of channel sands. However, for pump station 24 (nearest with data to basin), transmissivity = 258 m^2/day. For full pump test details, see attached sheet (K. Bogoda, unpublished data).

<kv and kh of aquitard> Transmissivity: 19-40 m^2/day (Piezometer 2175, DWR, Deniliquin)

<Thickness of aquitard> 3 to 40 metres

<kv and kh of aquifer> Shepparton Formation: Kh = 5-20 m/day (Williams and Woolley, 1992); Transmissivity = 19-594 m^2/day depending on whether there is a prior stream (DWR, 1988); Calivil Formation and Parilla Sand: Kh = 30-40 m/day, Kv = 0. 3 m/day (J. Kellet, pers. comm.); Renmark Group: Kh = 40-80 m/day (Williams and Woolley, 1992).

<EC of aquifer> Shepparton Formation = 1500-35 000 EC (Williams and Woolley, 1992); 15 000 mg/L TDS (Williams, 1993); 65,400 EC (Bore 678, DWR Deniliquin) to 105,000 EC (Bore 2650, DWR Deniliquin); Calivil Formation and Parilla Sand: 1000-7000 EC; Renmark Group: 1500-14,000 EC (Williams and Woolley, 1992).

<Porosity of aquifer>

<Thickness of aquifer> Shepparton Formation: 5-10 metres; Calivil Formation and Parilla Sand: 70 metres; Renmark Group: 230 metres.

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The Lower Shepparton Formation, confines the Pliocene Sand Aquifer and the Renmark Group under artesian pressure isolating Wakool from the major aquifers. However, the basin may leak into the Shepparton Formation if there is a sufficiently high permeability aquifer beneath the basin and if the Shepparton is under low pressure. Flowlines within the Shepparton Formation indicate that groundwater flows around the basin. This could be because it is isolated by a clay aquitard, or because it has formed a pressure gradient of its own, or a combination of both factors. The problem is further confused, because the watertable is kept artificially high by rice fields surrounding the basin that are kept flooded for 3-4 months out of the year. On an historical note, a recent law suit against the DWR was settled out of court, the agreement being, that the basin does not "leak significantly".

<Hydraulic linkage to surface runoff> None, a large interception trench captures water that leaks through banks and it is pumped back to the basin.

<Category - hydraulic stability>

<Site Name> Wakool Evaporation Basin
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus> 1246 mm/yr (Evaporation = 1584 mm/yr and precipitation = 338 mm/yr)

Interpretive 2

<Ranking of sustainability>

References Cited

Beale, P., and Moore, S., 1993- Wakool land and Water management Plan: District summary., NSW Agriculture, 96 p.

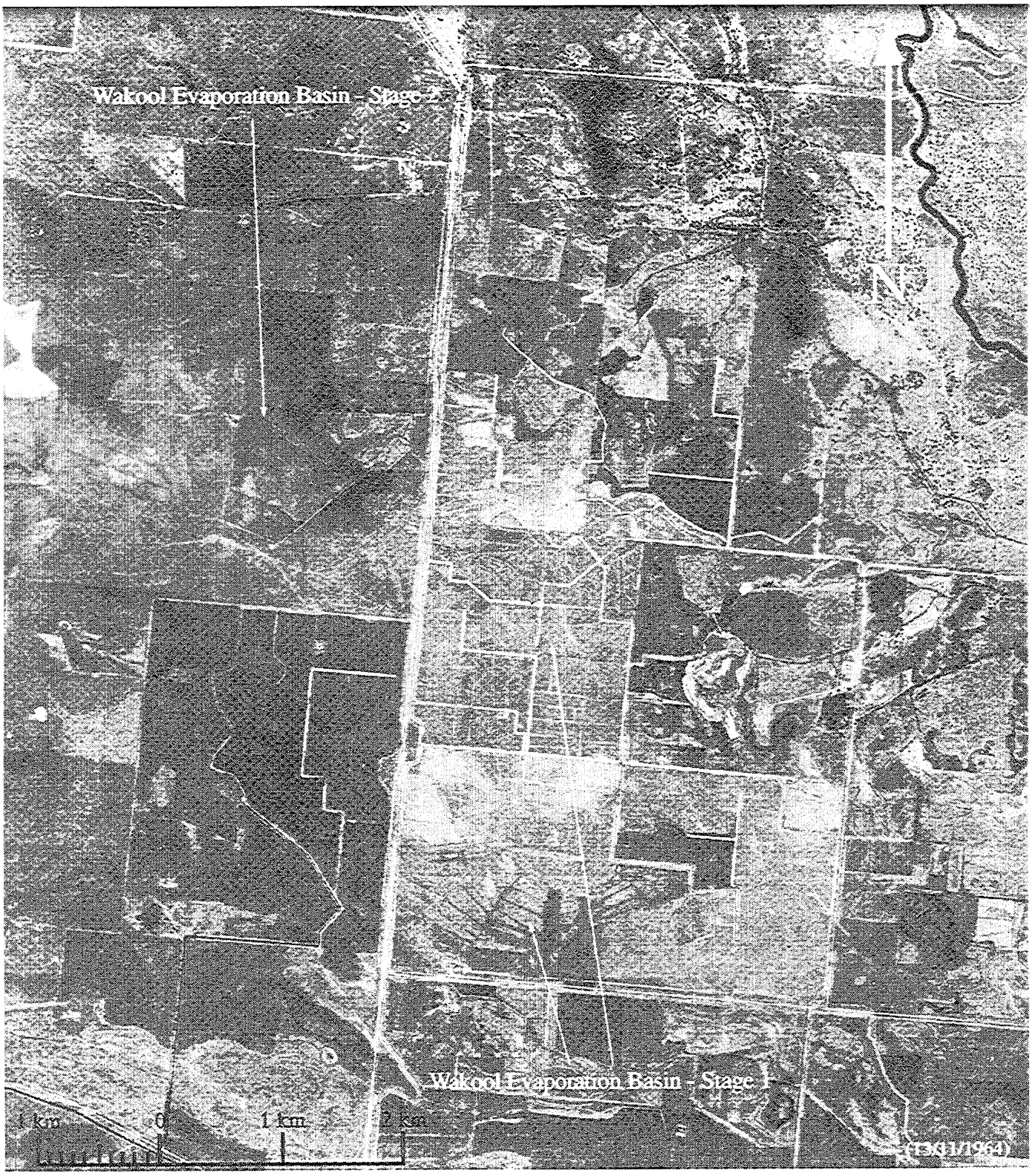
Department of Water Resources (DWR) (New South Wales), 1988- Report on stratigraphy and subsurface hydrology of the Wakool-Tullakool Salinity Sub-Surface Drainage Scheme Stage 2 Evaporation Basin.,

Overton, W., 1993- Groundwater conditions Berriquin, Wakool, Deniboota, and Denimein Irrigation Districts to Feb 1993, Department of Water Resources, Murray Region

Prince, S.D., 1991- Investigations on holdings 98,99, and 111 Wakool Irrigation District in accordance with 'out of court' settlement agreement., Department of Water Resources

Williams, R.M., 1993- Evaluation of Disposal Basins by Ranking in New South Wales, Department of Water Resources, Technical Services Division, 26 pp.

Williams, R.M. and Woolley, D. Department of Water Resources, 1992- Deniliquin Hydrogeological Map (1:250 000 scale), Australian Geological Survey Organisation, Canberra, Australia


Wakool Evaporation Basin - Stage 2
N
Wakool Evaporation Basin - Stage 1
1 km
0
1 km
2 km
(13/11/1964)

N

Wakool Evaporation Basin

S

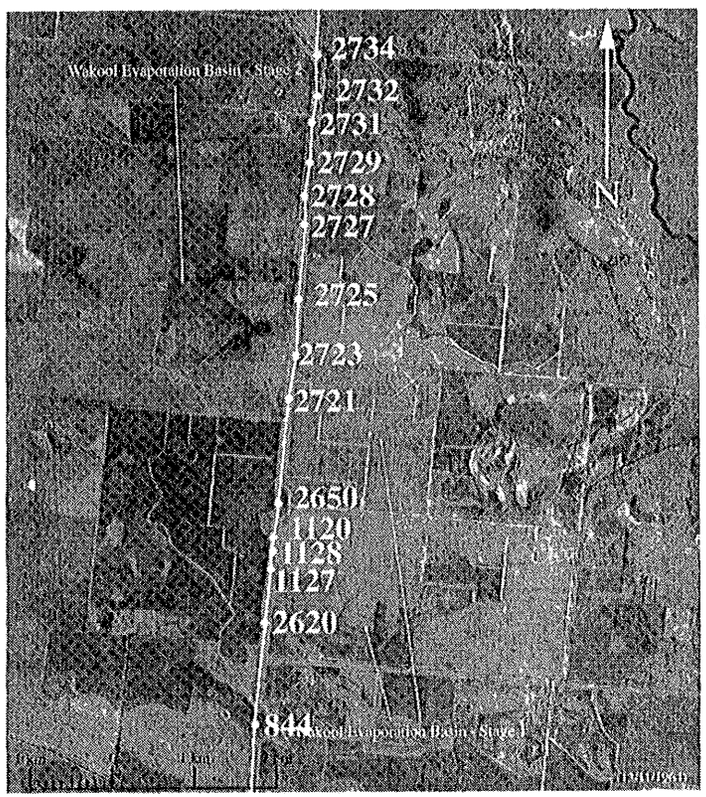
Elevation (AHD)

70

60

50

2757 2764 2734 2732 2731 2729 2728 2727 2725 2723 2721 2650 1120 1128 1127 2620 844 1475



aquifer lithofacies in this section are in bolder tones,
aquitard lithofacies are in grey tones

V/H 15

1995/4
V2
C2

AGSO

An inventory of saline water disposal basins, Murray Basin

BMR PUBLICATIONS COMPACTUS
(LENDING SECTION)

Volume 2
Victoria

By Stephen Hostetler & Bruce Radke

GEOLOGICAL SURVEY ORGANISATION
LIBRARY
14 MAR 1995
AUSTRALIAN

RECORD 1995/4

AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

AGSO
AUSTRALIAN
GEOLOGICAL SURVEY
ORGANISATION

BMR COMP
1995/4
V2
C2

AN INVENTORY OF SALINE WATER DISPOSAL BASINS, MURRAY BASIN

Volume 2

VICTORIA

Stephen Hostetler & Bruce Radke [1]

[1] Consultant,
18 Hartley Street, Turner ACT 2601

Prepared as a contribution to NRMS Project M4042
Managing disposal basins to maximize their usefulness for salt storage

Environmental Geoscience and Groundwater Program
Australian Geological Survey Organisation
Canberra

DEPARTMENT OF PRIMARY INDUSTRIES AND ENERGY

Minister for Resources: Hon. David Beddall, MP
Secretary: Greg Taylor

AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

Executive Director: Harvey Jacka

© Commonwealth of Australia 1994

ISSN: 1039-0073
ISBN: 0 642 22321 1

This work is copyright. Apart from any fair dealings for the purposes of study, research, criticism or review, as permitted under the *Copyright Act 1968*, no part may be reproduced by any process without written permission. Copyright is the responsibility of the Executive Director, Australian Geological Survey Organisation. Requests and inquiries concerning reproduction and rights should be directed to the **Principal Information Officer, Australian Geological Survey Organisation, GPO Box 378, Canberra City, ACT, 2601.**

CONTENTS

Volume 1

Introduction 1

Acknowledgements 3

References 4

Figures

1 Distribution of saline water disposal basins along the Murray River 14
2 Location of saline water disposal basins, Waikerie district, S.A 15
3 Location of saline water disposal basins, Barmera district, SA 16
4 Location of saline water disposal basins, Berri district, SA 17
5 Location of saline water disposal basins, Noora, SA 18
6 Location of saline water disposal basins, Renmark district, SA 19
7 Location of saline water disposal basins, Lake Victoria, NSW 20
8 Location of saline water disposal basins, Coomealla-Buronga region, NSW 21
9 Location of saline water disposal basins, Mildura region, Vic 22
10 Location of saline water disposal basins, Nangiloc-Colignan region, Vic 23
11 Location of saline water disposal basins, Robinvale region, Vic 24
12 Location of saline water disposal basins, Swan Hill region, Vic 25
13 Location of saline water disposal basins, Kerang region, Vic 26
14 Location of saline water disposal basins, Cohuna region, Vic 27
15 Location of saline water disposal basins, Griffith region, NSW 28
16 Lithological symbols for stratigraphic cross-sections 29

Appendix

1 Locations and elevations of boreholes used for stratigraphic sections 30

South Australia

Berri 34
Berri Council Stormwater 40
Berri East 45
Block "E" Floodplain 51
Brilka Creek 56
Bulyong Island 62
Cadell 69
Chowilla (Tilmy Flats) 76
Cobdogla 83
Cooltong 89

Disher Creek 95
Hart Lagoon 103
Holder Lagoon 109
K Country 114
Katarapko Island 119
Lake Bonney 126
Lake Merreti (and Clover Lake) 132
Lake Woolpoolool 139
Loveday Basin 145
Loveday South 151
Lyrup East 156
Lyrup South 162
Meander Loop 168
Mid Pike 174
Moorook IA (Watchels Lagoon) 179
Murrayview 184
Noora 189
Ramco Lagoon 194
Renmark Reservoir (Bookmark Creek) 198
Rufus River 203
Stockyard Plain (Woolpunda) 209

New South Wales

Fletcher's Lake 215
Holland Lakes 1 and 2 221
Holland Lake 3 226
Holland Lake 4 231
Mallee Cliffs 236
Mirrool Farm 196 242
Mirrool Farm 1061 248
Mirrool Farm 1068 (Fitzsimmons) 254
Mirrool Farm1393 (Bilbul) 260
Mirrool Farm 1810 (Sergei) 265
Mourquong Swamp 270
Nulla Discharge Complex 276
Scotia Lakes Discharge Complex 280
Wakool 284

Volume 2

Victoria

Boonoonar 290
Bothroyd Dick 296
Brickworks Billabong 302
Bullock Swamp 308
Carwarp 314
Castles Crossing 320
Coars Swamp 326
Colignan 332
Collett 338
Commercial Vehicles Ltd 345
Cowanna Billabong 348
Dow Avenue Woodlots 354
Dry Lake 359
FMIT 1 365
FMIT 2 371
FMIT 3 376
FMIT 4 381
FMIT 5 387
FMIT 6 392
FMIT 7a 397
FMIT 7b 403
FMIT 7c 408
FMIT 7d 413
FMIT 8 419
FMIT 9 424
FMIT 10 429
FMIT 11 434
Forbes 66 439
Forbes 67 444
Frankel/MPI 449
Girgarre 452
Gunbower 458
Hall/Dyson 463
Hards 468
Jacksons-Mat 473
John 479
Karadoc Swamp 485
Kentias 492
Lake Batyo Catyo 499
Lake Hawthorn 503
Lake Iraak 510
Lake Kelly 516
Lake Little 522
Lake Ranfurly East 527

Lake Ranfurly West..... 533
Lake Tutchewop..... 539
Lake William..... 546
Lamberts Swamp..... 552
Lindsay Point..... 558
Margooya Lagoon..... 564
Martin..... 570
McEwans..... 573
Mercer Street..... 580
Mincha West..... 585
Mineral Reserve Basin..... 592
Nangiloc-Colignan..... 598
Nyah..... 603
Old Dam..... 608
Psyche Bend Lagoon..... 614
Robinvale East..... 620
Robinvale West..... 626
RWC 1..... 632
RWC 4..... 637
RWC 5..... 642
RWC 6..... 648
RWC 7..... 653
RWC 8..... 658
RWC 9..... 663
RWC 12..... 668
RWC 13..... 674
RWC 14..... 679
RWC 15..... 684
RWC 16..... 687
RWC 17..... 694
RWC 18..... 699
RWC A..... 704
RWC B..... 709
RWC C, D, E..... 714
RWC Southeast..... 719
Sandilong Park..... 725
Smith..... 730
Smiths..... 733
Sunncliffs/Minters..... 739
Sutherlands..... 744
Tresco Golf Club..... 749
Tresco Kunat Kunat..... 754
Tresco Long Lake..... 759
Tresco Round Lake..... 764
Vartuli/Musgrove..... 769
Wakefield..... 774

Wargan Basin 1 777
Wargan Basin 2 783
Wargan Basin 3 789
Wargan Basin 4 795
Wargan Basin 4a 801
Wargan Basin 5 806
Woorinen Holloways 812
Woorinen Murrawee 818
Woorinen North 824
Woorinen South 830
Wrens Swamp 836
Yatpool 841

<Site Name> Boonoonar Basins
<Synonyms>

Spatial

<Location description>10 kilometres west of Colignan, Victoria and 7 kilometres NNE of Nowingi, Victoria

<Located in Murray Trench> Yes

<Location 1:250 000> Mildura

<Location 1:100 000> Nowingi 7328

<Zone> 54H

<Coordinates easting (AMG)> 613500

<Coordinates northing (AMG)> 6175500

<State> **Victoria**

General

<Year begun operation>

<Active/inactive>

<Full surface area (ha)> Group of 4 basins: Total 400 Ha

<Volume capacity (ML)>

<Full surface level (m AHD)> 37-38 m AHD (1-2 m deep)

<Groundwater level (m AHD)> 37.3 m AHD (RWC, 1991)

<Groundwater seepage/discharge> Discharge

<Average annual evaporation> 1980 mm Class A pan Red Cliffs

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)>

<Sources of water to be disposed> Tile drainage and regional groundwater discharge

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> Boonoonar Basins
<Synonyms>

Engineering/Admin

<Public or private operation> Public

<Agency responsible> Rural Water Corporation

<Project name> Boonoonar Basin

<Natural, modified natural or constructed> Natural

<Modification type and degree> None

Geological

<Site description and Geomorphology> The basin is located on the edge of the trench within the Rufus Terrace and is surrounded by the longitudinal Woorinen dunes. It is a site of regional groundwater discharge and also receives some overland flow as well. Evidence from air photo interpretation suggests that there is wide scale surface salinisation, but no long term surface water.

<Subsurface investigations at site>

<Structural setting> The basin lies within the Raak Trough (Thorne, Hoxley, and Chaplin, 1990).

<Stratigraphic setting> The basin is floored by the Woorinen Formation (0-10 m), and is underlain by the Rufus Formation (5-7 m), the Channel Sand (Monoman Formation) (5 m), the Blanchetown Clay (30 m), the Parilla Sand (70 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<Host formation> Woorinen Formation (Yamba Formation as well)

<Host lithofacies> Woorinen Formation: Red silt and sand; Yamba Formation: Salt, clay, and gypsum

<Aquitard> Rufus Formation and Blanchetown Clay

<Aquitard lithofacies> Rufus Formation: Silt and clay; Blanchetown Clay: Clay and silty clay

<Aquifer> Channel Sand and Parilla Sand

<Aquifer lithofacies> Channel Sand and Parilla Sand: Medium to coarse, quartz sand

<Comments>

Summary of Hydrodynamics

<Distance to Murray or tributary> 12 kilometres

<Head between basin and river/tributary>

<Site Name> Boonoonar Basins
<Synonyms>

<Direction of groundwater flow in regional aquifer> WNW away from river (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard> Rufus Formation: Permeability several orders of magnitude less than Channel Sand (Linke, 1993)

<Thickness of aquitard> Rufus Formation: 5-7 metres; Blanchetown Clay: 30 metres

<kv and kh of aquifer> Channel Sand: Kh = 40 m/day (Linke, 1993)

<EC of aquifer> Channel Sand: 45,000 EC; Parilla Sand: 50,000 EC (Linke, 1990b)

<Porosity of aquifer>

<Thickness of aquifer> Channel Sand: 5 metres; Parilla Sand: 70 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Boonoonar Basin is a natural salina located on the Rufus Terrace, which currently receives groundwater discharge. Although the amount of discharge is unknown, it would have to be over 4000 ML/yr (1 metre depth) in order to raise the pool level above that of the potentiometric surface of the Channel Sand (Linke, 1990b). Leakage should also be contained by the Rufus Formation which is thought to leak at a rate of 0.4 ML/yr/Ha (Linke, 1990b) (Although the Rufus Formation may be deflated beneath the basin).

Problems may be encountered however, in the perched aquifer in the Woorinen Formation. There disposal may enlarge the size of the perched watertable around the basin causing an increase in salinisation in low lying areas around the basin. The Parilla Sand is effectively isolated from the Channel Sand by the Blanchetown Clay except north of Karadoc Swamp where faulting has brought the Parilla Sand to the surface. However, since there should be no inflow into the Channel Sands from the basin the Parilla Sand should still be protected.

<Hydraulic linkage to surface runoff> Surface runoff will enter the Woorinen Formation.

<Category - hydraulic stability>

<Site Name> Boonoonar Basins
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus> 7900 ML (1980 mm/ha/yr x 400 ha)

Interpretive 2

<Ranking of sustainability>

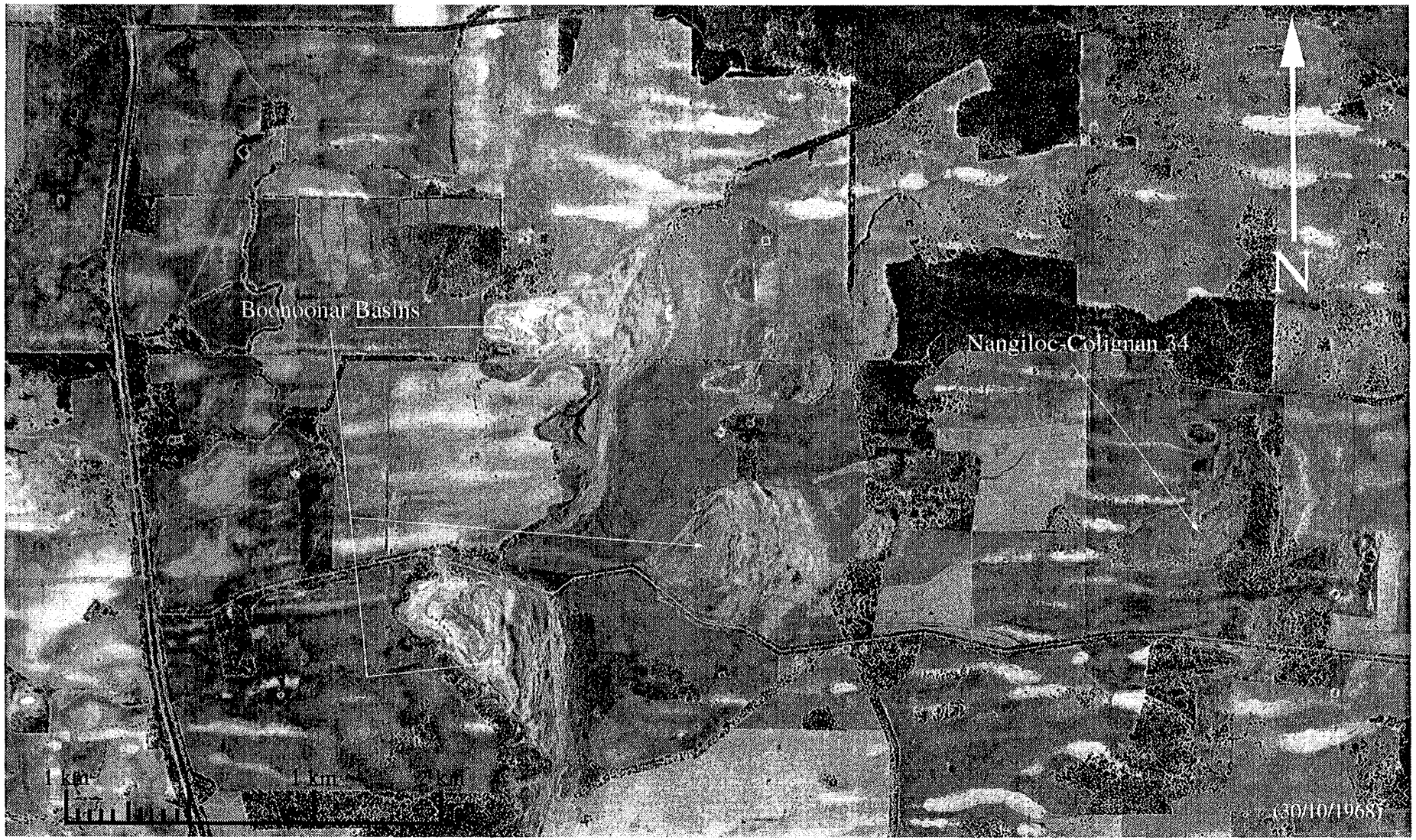
References Cited

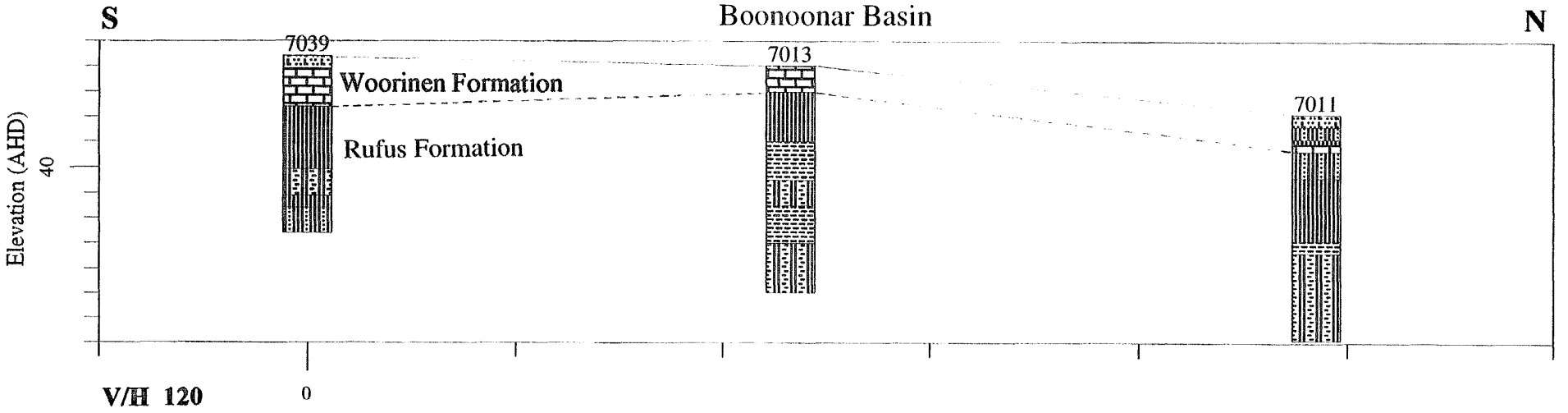
Linke, G., 1993- Nangiloc Colignan SMP - Drainage disposal to Karadoc Swamp - CMS Comps., Rural Water Corporation, Unpublished working file No. 93/01895

Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


Boonboonar Basins
Nangiloc-Colignan 34
N
1 km
1 km
(30/10/1968)


S
Boonoonar Basin
N
7039
7013
7011
Woorinen Formation
Rufus Formation
Elevation (AHD)
40
0
V/H 120


7013
N

<Site Name> Bothroyd Dick
<Synonyms>

Spatial

<Location description> 1.5 kilometres south of Colignan, Victoria and 14 kilometres north of Lake Bitterang.

<Located in Murray Trench> Yes

<Location 1:250 000> Mildura

<Location 1:100 000> Nowingi 7328

<Zone> 54

<Coordinates easting (AMG)> 625500

<Coordinates northing (AMG)> 6177200

<State> Victoria

General

<Year begun operation>

<Active/inactive>

<Full surface area (ha)> 8 ha

<Volume capacity (ML)>

<Full surface level (m AHD)> 42 m AHD (RWC map 147161)

<Groundwater level (m AHD)>

<Groundwater seepage/discharge>

<Average annual evaporation> 1980 mm Class A pan Red Cliffs

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)> 800-5000 EC average 1500 EC

<Range of salinity in basin (EC)> Dry

<Sources of water to be disposed> Tile Drains

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> Bothroyd Dick
<Synonyms>

Engineering/Admin

<Public or private operation> Private

<Agency responsible> Landholder

<Project name> Bothroyd Dick

<Natural, modified natural or constructed> Modified natural

<Modification type and degree>

Geological

<Site description and Geomorphology> The basin is located on a pediment of Blanchetown Clay bounded on the north, south, and west by the Woorinen Formation and on the east by the Murray Trench.

<Subsurface investigations at site>

<Structural setting> The basin is located within the Raak Trough (Thorne, Hoxley, and Chaplin, 1990).

<Stratigraphic setting> The basin is floored by the Woorinen Formation (0-2 m), and is underlain by the Blanchetown Clay (25-30 m), the Parilla Sand (65 m), the Bookpurnong Beds, the Murray Group Limestone, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<Host formation> Woorinen Formation

<Host lithofacies> Red silt and sand

<Aquitard> Blanchetown Clay

<Aquitard lithofacies>

<Aquifer> Woorinen Formation and Parilla Sand

<Aquifer lithofacies> Woorinen Formation: Red silts and sands; Parilla Sand: Unconsolidated fine to medium sand

<Comments>

Summary of Hydrodynamics

<Distance to Murray or tributary> 500 metres

<Head between basin and river/tributary>

<Site Name> Bothroyd Dick
<Synonyms>

<Direction of groundwater flow in regional aquifer> East towards the river (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Blanchetown Clay: 25-30 metres

<kv and kh of aquifer>

<EC of aquifer> Parilla Sand: 35,000-50,000 mg/L TDS

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 65 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The Parilla Sand is isolated from the basin by 25-30 metres of Blanchetown Clay and therefore should receive no discharge. Depending on the amount of disposal there may be leakage into the perched aquifer within the Woorinen Formation and Channel Sand. The size of the mound should be relatively small, however because of the high salinity within the basin 50,000-70,000 EC it could be potentially harmful. Overall though, compared to the size of the irrigation mound within in the Woorinen Formation it should have little effect.

<Hydraulic linkage to surface runoff> Possible saline water entering the river during high flows.

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Site Name> Bothroyd Dick
<Synonyms>

<Evaporation surplus>

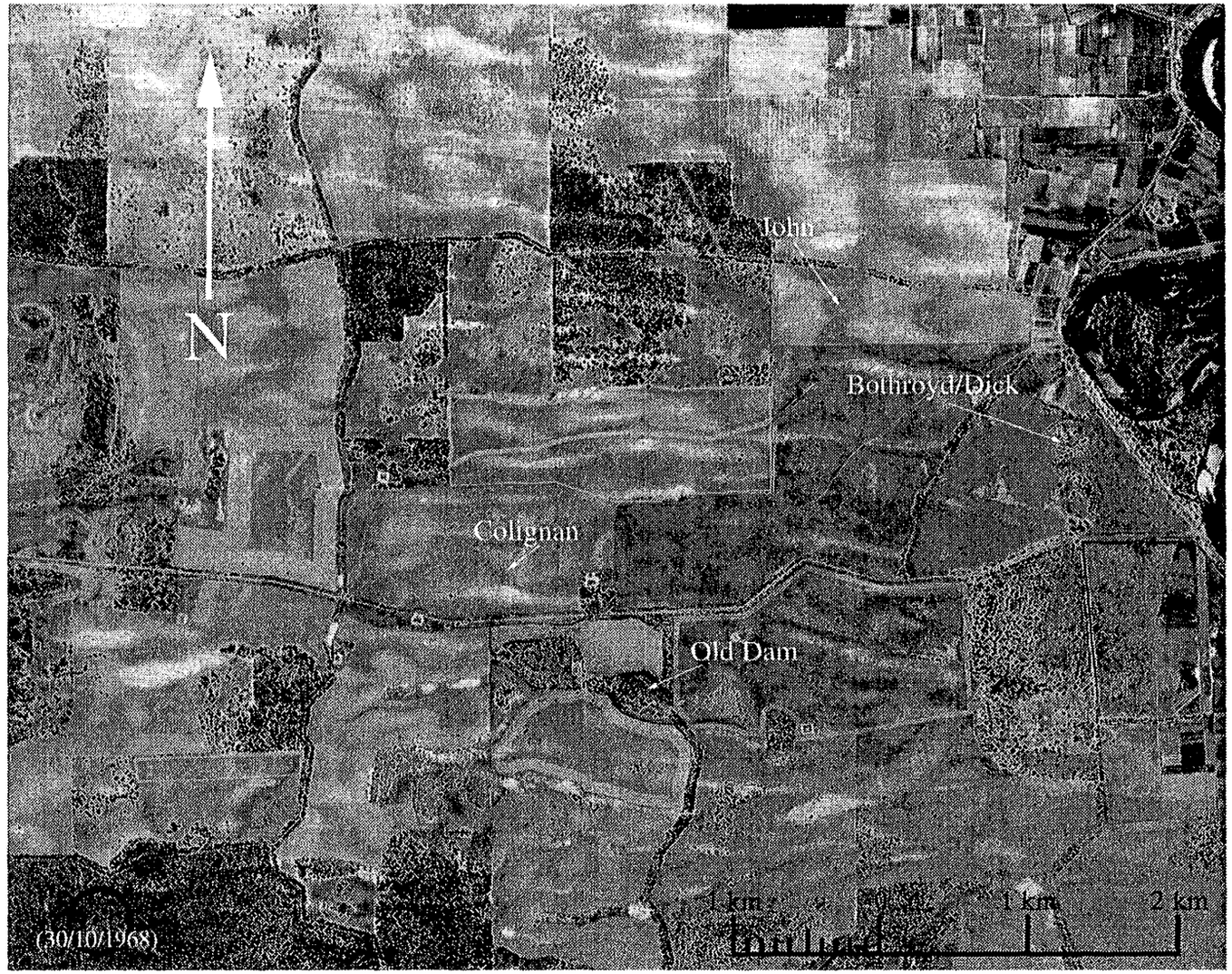
Interpretive 2

<Ranking of sustainability>

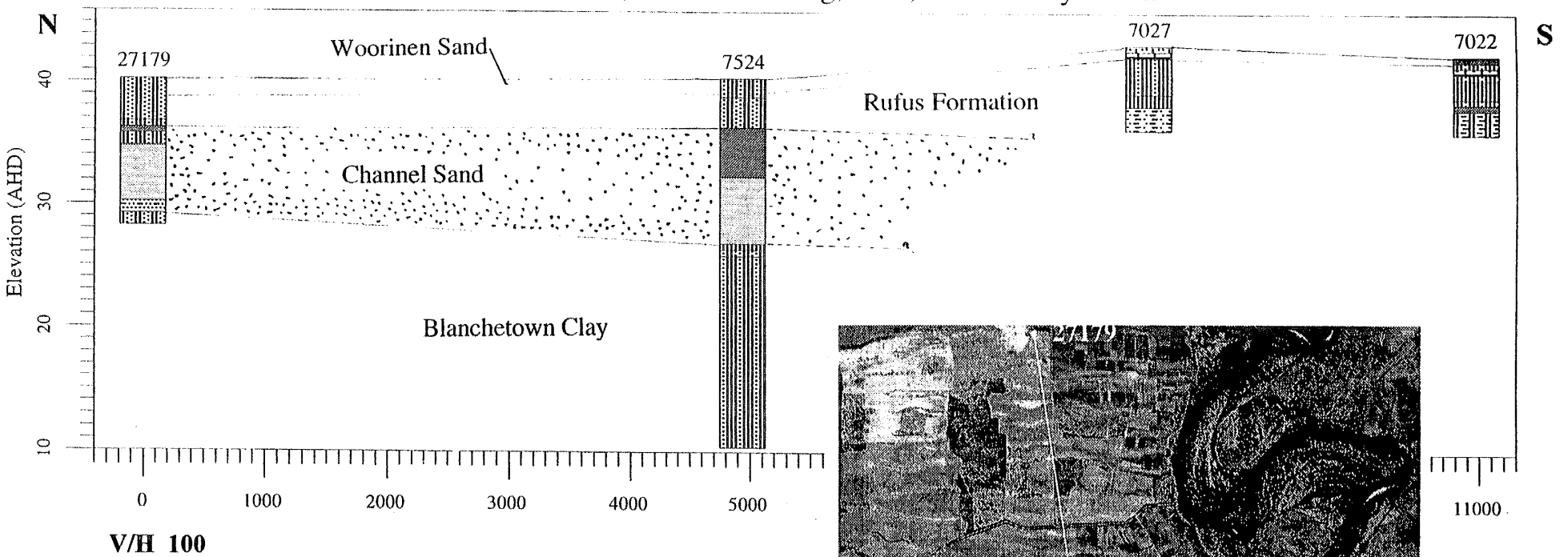
References Cited

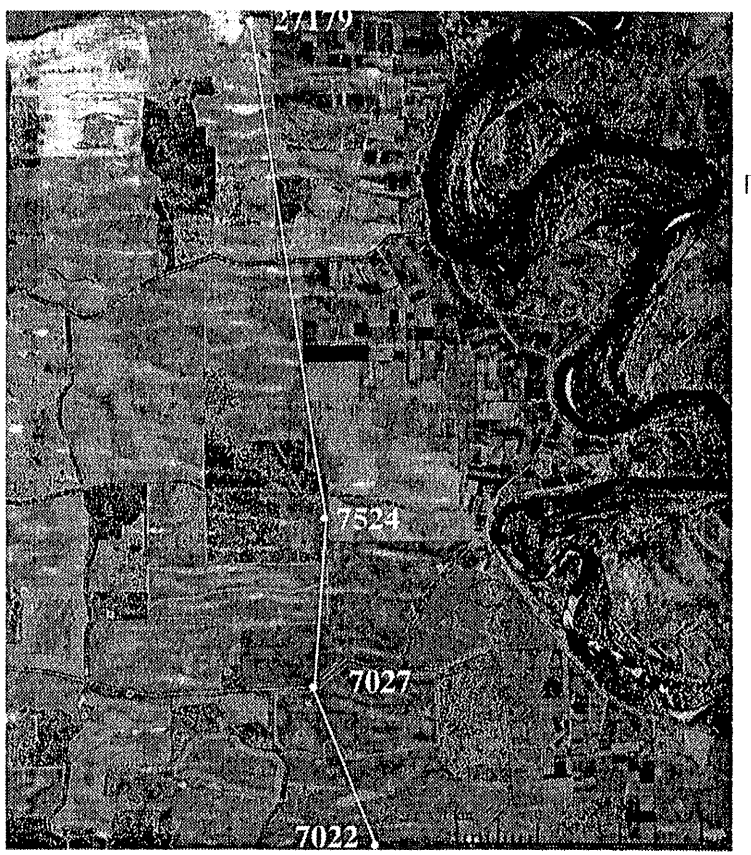
Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
John
Bothroyd/Dick
Colignan
Old Dam
1 km
0
1 km
2 km
(30/10/1968)

Jacksons-Mat, Castles Crossing, John, and Bothroyd Dick





<Site Name> Brickworks Billabong
<Synonyms>

Spatial

<**Location description**> 3 kilometres NW of Merbein, Victoria and 5 kilometres south of Dareton, NSW

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 595300

<**Coordinates northing (AMG)**> 6221500

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 20 ha

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> 32 m AHD (No survey)

<**Groundwater level (m AHD)**> 35 m AHD

<**Groundwater seepage/discharge**> Discharge

<**Average annual evaporation**> 1980 mm Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**> 26 ML/year estimate

<**Salinity of water disposed (EC)**> 1500-3000 EC (C, Thompson, pers. comm. 1993); 38,000 mg/L (Hoxley, 1991)

<**Range of salinity in basin (EC)**> 4530-110,200 EC

<**Sources of water to be disposed**> Groundwater discharge

<**Terminal/throughflow basin**> Throughflow to Cowanna Billabong

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**> High watertable due to irrigation mound will increase floodplain degradation

<Site Name> Brickworks Billabong
<Synonyms>

Engineering/Admin

<**Public or private operation**> Private

<**Agency responsible**>Landholders

<**Project name**> Brickworks Billabong

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Banks have been built

Geological

<**Site description and Geomorphology**> The basin is a stranded meander of the Murray River bounded on the southwest by the edge of the trench and otherwise by the floodplain.

<**Subsurface investigations at site**> 3 bores in area (RWC 7444, 7445, 7446)

<**Structural setting**> The basin is on the Merbein Ridge northwest of the Danyo Fault and east-southeast of the Yelta Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Coonambidgal Formation (10 m), and is underlain by the Channel Sand (Monoman Formation) (15-20 m), the Parilla Sand (30 m), the Bookpurnong Beds, the Murray Group Limestone, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Coonambidgal Formation

<**Host lithofacies**> Fine sand, clayey sand, sandy clay, and clay

<**Aquitard**> Coonambidgal Formation, Bookpurnong Beds

<**Aquitard lithofacies**> Coonambidgal Formation: sandy clay and clay

<**Aquifer**> Channel Sand and Parilla Sand (Connected in trench)

<**Aquifer lithofacies**> Fine to coarse sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> <500 metres

<Site Name> Brickworks Billabong
<Synonyms>

<Head between basin and river/tributary> On floodplain

<Direction of groundwater flow in regional aquifer> North to northeast towards the river (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Coonambidgal Formation: 5-10 metres

<kv and kh of aquifer> Kh = 2 m/day (Worst case) (Hoxley, 1991)

<EC of aquifer> > 20,000 mg/L TDS

<Porosity of aquifer>

<Thickness of aquifer> Channel Sand and Parilla Sand: 40-45 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The Merbein Ridge acts as a major groundwater barrier forcing the Renmark Group to be under artesian pressure. Combined with this is the large (12 metres) irrigation mound beneath Merbein which results in an almost total flushing of the Parilla Sand beneath ridge (Thorne, Hoxley, and Chaplin, 1990). Groundwater flows radially away from the ridge including large volumes into the Murray Trench part of which is intercepted by Brickworks Billabong. The basin stores the water until it can be flushed to Cowanna Billabong and from there it is released to the Murray River during high flows when the basin may be flushed directly. Problems may arise because of the connection between the Channel Sand and the Parilla Sand which allows groundwater to enter the Murray directly; and because of the high salinities in the basin (>100,000 EC). The connection provides a conduit by which high salinity water may enter the Murray River during periods of low flow when the hydraulic gradient towards the river is greatest.

<Hydraulic linkage to surface runoff> High river flows will submerge the basin.

<Category - hydraulic stability>

<Site Name> Brickworks Billabong
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

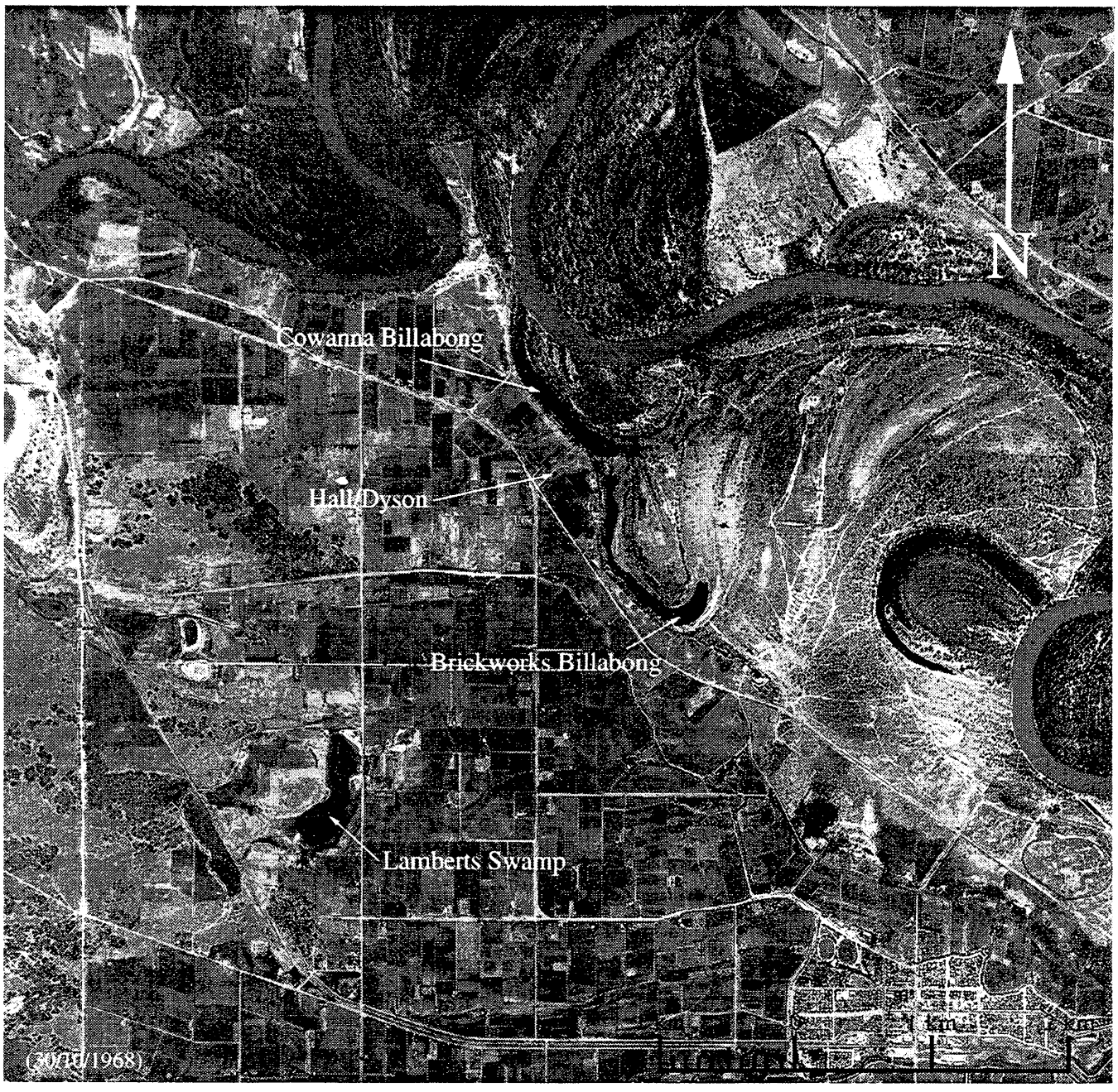
<Ranking of sustainability>

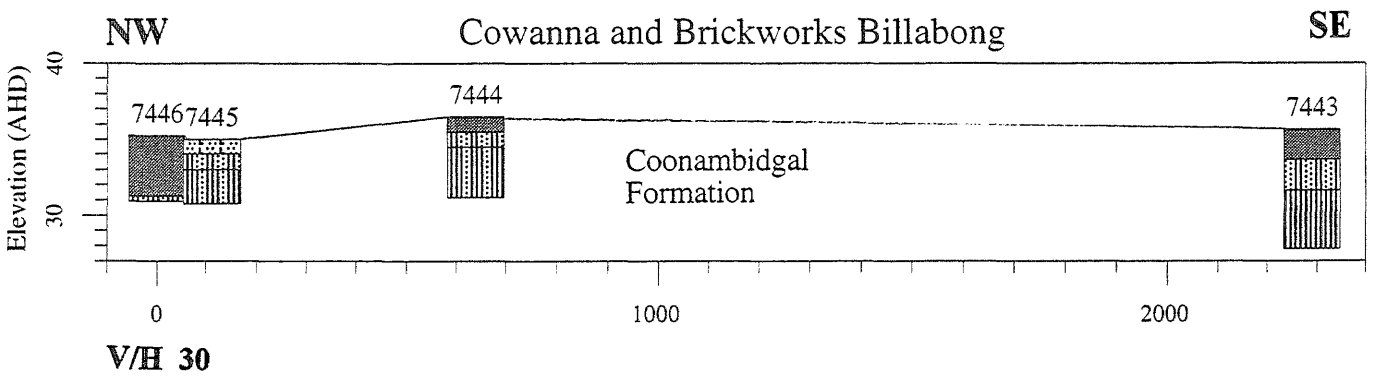
References Cited

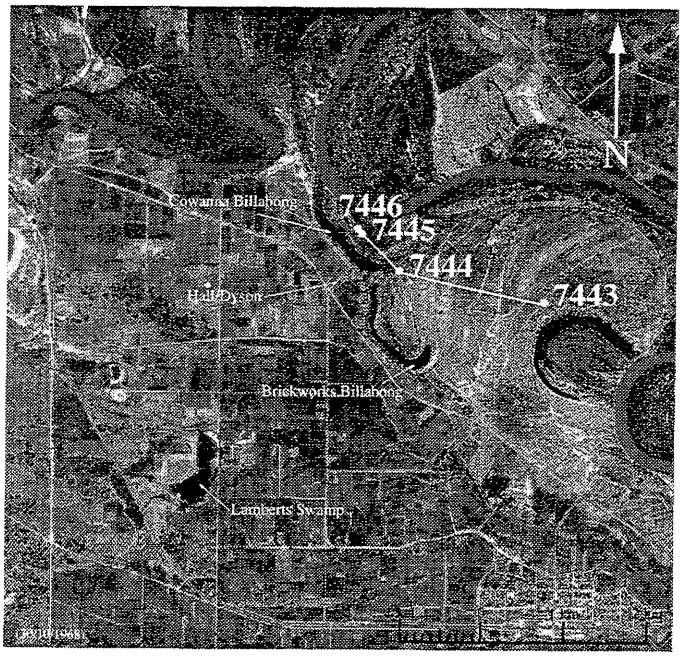
Hoxley, G., 1991- Hydrogeological summary of wetland areas in the Sunraysia Salinity Management Plan Area., Rural Water Corporation, Groundwater Section, Technical note 1

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
Cowanna Billabong
Hall/Dyson
Brickworks Billabong
Lamberts Swamp
1 km
(30/10/1968)


NW
Cowanna and Brickworks Billabong
SE
Elevation (AHD)
40
30
74467445
7444
7443
Coonambidgal
Formation
0
1000
2000
V/H 30


N
Cowanna Billabong
7446
7445
7444
7443
Brickworks Billabong
Lamberts Swamp

<Site Name> Bullock Swamp
<Synonyms>

Spatial

<**Location description**> 5 kilometres NNW of Nangiloc, Victoria and 13 kilometres ENE of Carwarp, Victoria

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 622600

<**Coordinates northing (AMG)**> 6188200

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 30 ha (RWC, 1993); 280 ha (???. 1975)

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> 37 m AHD (estimated only)

<**Groundwater level (m AHD)**> Channel Sand: 37-38 m AHD, Parilla Sand: 37.1 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<**Groundwater seepage/discharge**> Discharge

<**Average annual evaporation**> Inflow/evaporation = 0.7; 1980 mm/yr Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**> 282 ML/yr

<**Salinity of water disposed (EC)**> 2000 EC

<**Range of salinity in basin (EC)**> Dry

<**Sources of water to be disposed**> Groundwater discharge (40 ML), Tile drains (282 ML), River water

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> Bullock Swamp
<Synonyms>

Engineering/Admin

<**Public or private operation**> Private

<**Agency responsible**> Rural Water Corporation

<**Project name**> Bullock Swamp

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Banks have been built

Geological

<**Site description and Geomorphology**> The basin is located within the Murray Trench and sits within the Rufus Terrace, although the basin is floored by the Coonambidgal Formation. There is a large lunette on the eastern margin of the basin indicating past usage as a groundwater discharge site. It is connected to Lake Iraak in the northwest and to the Murray River (during high flows) by a channel in the northeastern corner.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located northwest of the Raak Trough and southeast of the Neckarboo Ridge (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Coonambidgal Formation (3 m), and is underlain by the Channel Sand (6-10 m), the Blanchetown Clay (17-25 m), the Parilla Sand (70 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Coonambidgal Formation

<**Host lithofacies**> Silt and clay

<**Aquitard**> Coonambidgal Formation and Blanchetown Clay

<**Aquitard lithofacies**> Coonambidgal Formation: Silt and clay; Blanchetown Clay: Clay

<**Aquifer**> Channel Sand and Parilla Sand

<**Aquifer lithofacies**> Channel Sand and Parilla Sand: Medium to coarse sand

<**Comments**>

<Site Name> Bullock Swamp
<Synonyms>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 500 metres

<**Head between basin and river/tributary**>

<**Direction of groundwater flow in regional aquifer**> ENE towards the river (RWC, 1991)

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**>

<**Thickness of aquitard**> Coonambidgal Formation: 3-5 metres; Blanchetown Clay: 17-25 metres (thinning northward towards the Neckarboo Ridge)

<**kv and kh of aquifer**> Channel Sand: Kh = 10-40 m/day, Parilla Sand: Kh = 1 m/day (Linke, 1990b)

<**EC of aquifer**> > 50,000 mg/L TDS (RWC, 1993); Channel Sand: 40,00-50,000 EC, Parilla Sand: 20,000 EC (Thorne, Hoxley, and Chaplin, 1990)

<**Porosity of aquifer**> 20% (Linke, 1990b)

<**Thickness of aquifer**> Channel Sand: 6-10 metres; Parilla Sand: 70 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> Bullock Swamp intercepts about 60 % of the incoming groundwater of the Channel Sand, which is approximately 40 ML/yr contributing 1200 tonnes of salt/yr (30,000 mg/L) (Linke, 1993). Combined with the amount of disposal water (282 ML/yr) for a total input (not including rainfall) of 322 ML/yr. It has an evaporative capacity of 5500 ML/yr (1980 mm/yr evaporation x 280 ha), which means that the basin is usually dry. There should be little chance of the disposal water entering the Channel Sand because of the high potentiometric surface of the Channel Sand, the high evaporative capacity of the basin (resulting in little water available to infiltrate), and because of the aquitard characteristics of the Coonambidgal Formation. However, if the Coonambidgal Formation develops cracks due to drying out it could provide an access point to the Channel Sand and from there direct to the river.

<**Hydraulic linkage to surface runoff**> The basin is inundated during high flow levels.

<**Category - hydraulic stability**>

<Site Name> Bullock Swamp
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus> Evaporation capacity is over 5500 ML/yr which is far in excess of the total inputs to the basin.

Interpretive 2

<Ranking of sustainability>

References Cited

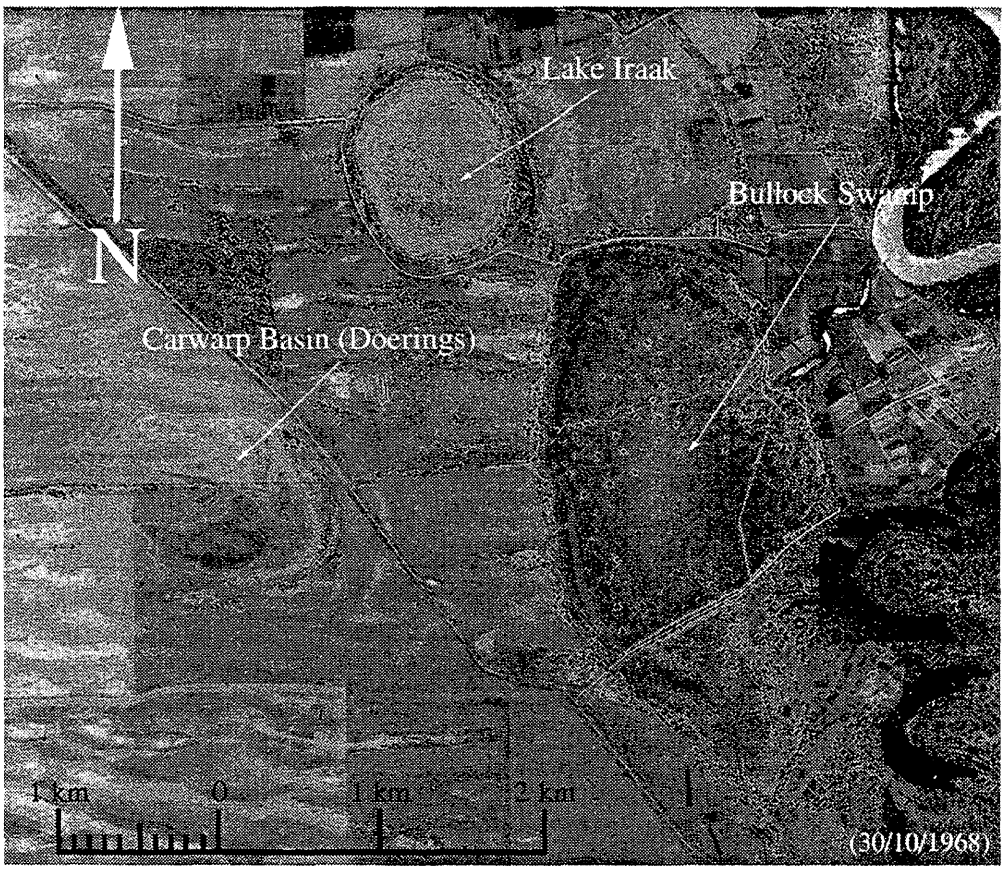
Barling. R., and Linke, G., 1993- Nangiloc Colignan Salinity Management Plan Technical note on Lake Iraak and Doerings Basin., Rural Water Corporation, Unpublished technical note

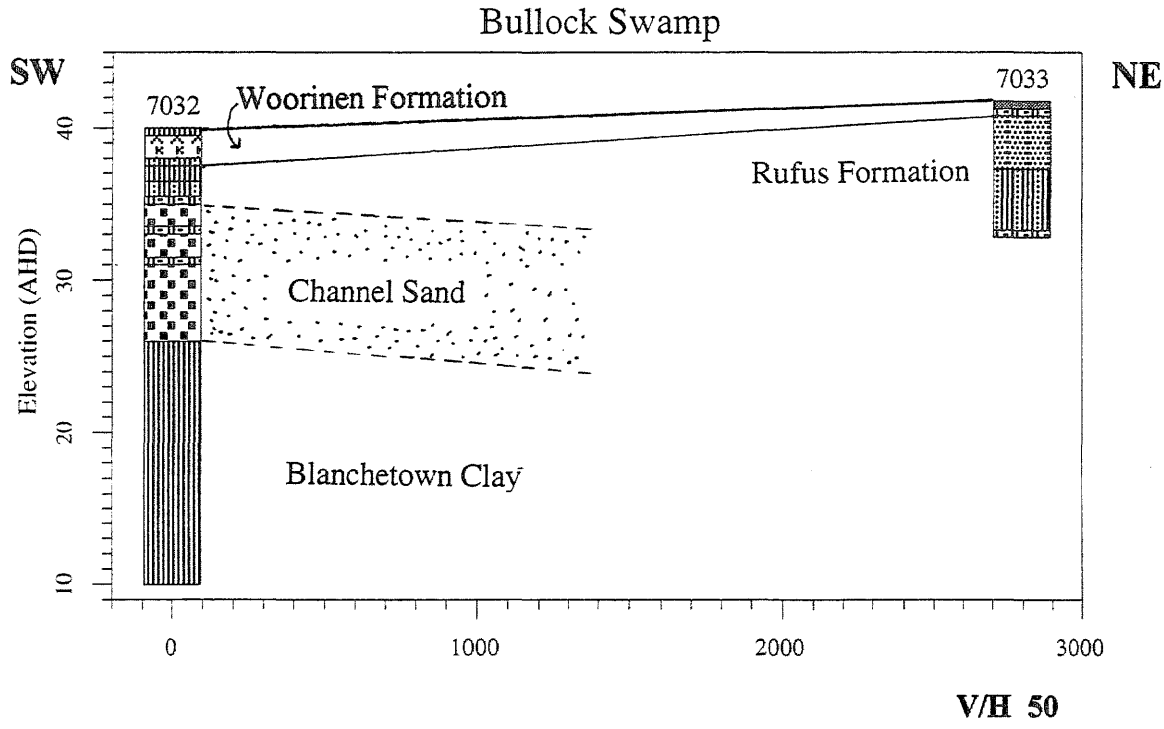
Linke, G., 1993- Nangiloc Colignan SMP - Drainage disposal to Karadoc Swamp - CMS Comps., Rural Water Corporation, Unpublished working file No. 93/01895

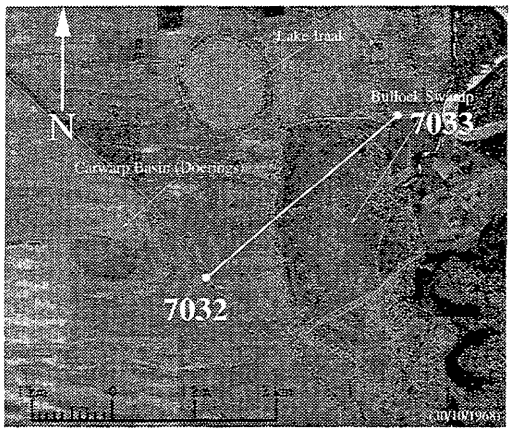
Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


Lake Iraak
Bullock Swamp
N
Carwarp Basin (Doerings)
1 km
0
1 km
2 km
(30/10/1968)


Bullock Swamp
SW
NE
7032
7033
Woorinen Formation
Rufus Formation
Channel Sand
Blanchetown Clay
Elevation (AHD)
40
30
20
10
0
1000
2000
3000
V/H 50


N
Lake Tyrrell
Bullock Swamp
7033
7032

<**Site Name**> Carwarp Basins
<**Synonyms**> Doerings Basin

Spatial

<**Location description**> 2 kilometres SSW of Lake Iraak and 9 kilometres ENE of Carwarp, Victoria

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 620400

<**Coordinates northing (AMG)**> 6188600

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 103 ha (RWC, 1993); at 39 m AHD = 74 ha, at 37.8 m AHD = 45.8 ha (Barling and Linke, 1993)

<**Volume capacity (ML)**> at 39 m AHD = 916 ML, at 37.8 m AHD 171.6 ML (Barling and Linke, 1993)

<**Full surface level (m AHD)**> 37.8 m AHD (old hight); 39 m AHD (with banks)

<**Groundwater level (m AHD)**> Channel Sand: 38.6 m AHD (Linke, 1990b); Parilla Sand: 37.5 m AHD (Barling and Linke, 1993)

<**Groundwater seepage/discharge**> Discharge

<**Average annual evaporation**> Inflow/evaporation = 0.3; 1980 mm/yr Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**> 477 ML/yr

<**Salinity of water disposed (EC)**> 2000 EC

<**Range of salinity in basin (EC)**>

<**Sources of water to be disposed**> Groundwater

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> Carwarp Basins
<Synonyms> Doerings Basin

Engineering/Admin

<Public or private operation> Private

<Agency responsible> Landholders

<Project name> Carwarp Basins/Doerings Basin

<Natural, modified natural or constructed> Natural

<Modification type and degree> None

Geological

<Site description and Geomorphology> The basin is located on the Rufus Terrace within the Murray Trench. It is surrounded and developed within the longitudinal Woorinen dunes and appears to have operated as a discharge zone in the past (Yamba Formation present?).

<Subsurface investigations at site>

<Structural setting> Northwest of the Raak Trough, northeast of the Wargan Fault and southeast of the Neckarboo Ridge (Linke, 1990b).

<Stratigraphic setting> The basin is floored by the Woorinen Formation (Yamba Formation as well?) (3 m), and is underlain by the Rufus Formation (3 m), the Channel Sand (Monoman Formation) (7 m), the Blanchetown Clay (15 m), the Parilla Sand (70 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<Host formation> Woorinen Formation

<Host lithofacies> Red silts and sand (Possibly some gypsum, salt, and clay)

<Aquitard> Rufus Formation and Blanchetown Clay

<Aquitard lithofacies> Rufus Formation: Silt and silt clay; Blanchetown Clay: Clay

<Aquifer> Channel Sand and Parilla Sand

<Aquifer lithofacies> Channel Sand and Parilla Sand: Medium to coarse quartz sand

<Comments>

Summary of Hydrodynamics

<Distance to Murray or tributary> 4 kilometres

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Northwest away from the river (RWC,

<Site Name> Carwarp Basins
<Synonyms> Doerings Basin

1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Rufus Formation: 3 metres; Blanchetown Clay: 15 metres

<kv and kh of aquifer> Channel Sand: Kh = 40 m/day (Linke, 1993)

<EC of aquifer> > 50,000 mg/L TDS (RWC, 1993); Channel Sand: 45,000 EC; Parilla Sand: 35,000 EC (Linke, 1990b)

<Porosity of aquifer>

<Thickness of aquifer> Rufus Formation: 5 metre; Parilla Sand: 70 metres

<kv and kh of alluvial aquifer> 40 m/day (Linke, 1993)

<Pre-existing potentiometric surface> Before disposal groundwater level was 37.8 m AHD with flow into the basin (Linke and Samarasinghe, 1993)

Interpretive 1

<Hydraulic linkage to regional aquifer> Carwarp Basin is a natural salina located on the Rufus Terrace and underlain by the Channel Sand. However, it is effectively isolated from the regional aquifer due to the high regional water table within the Channel Sand and the low permeability Rufus Terrace (Leakage 0.4 ML/yr/ha) (Linke, 1993). Leakage from the basin will only occur if disposal exceeds the evaporation capacity (currently inflow/evaporation equals 0.3) thereby raising the lake level above 39.0 m AHD. The most likely scenario is for the basin to leak horizontally into the perched aquifer in the Woorinen Formation.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Site Name> Carwarp Basins
<Synonyms> Doerings Basin

<Evaporation surplus> Evaporation capacity = 1465 ML/yr and inflow = 477 ML/yr.

Interpretive 2

<Ranking of sustainability>

References Cited

Barling. R., and Linke, G., 1993, Nangiloc Colignan Salinity Management Plan Technical note on Lake Iraak and Doerings Basin., Rural Water Corporation, Unpublished technical note

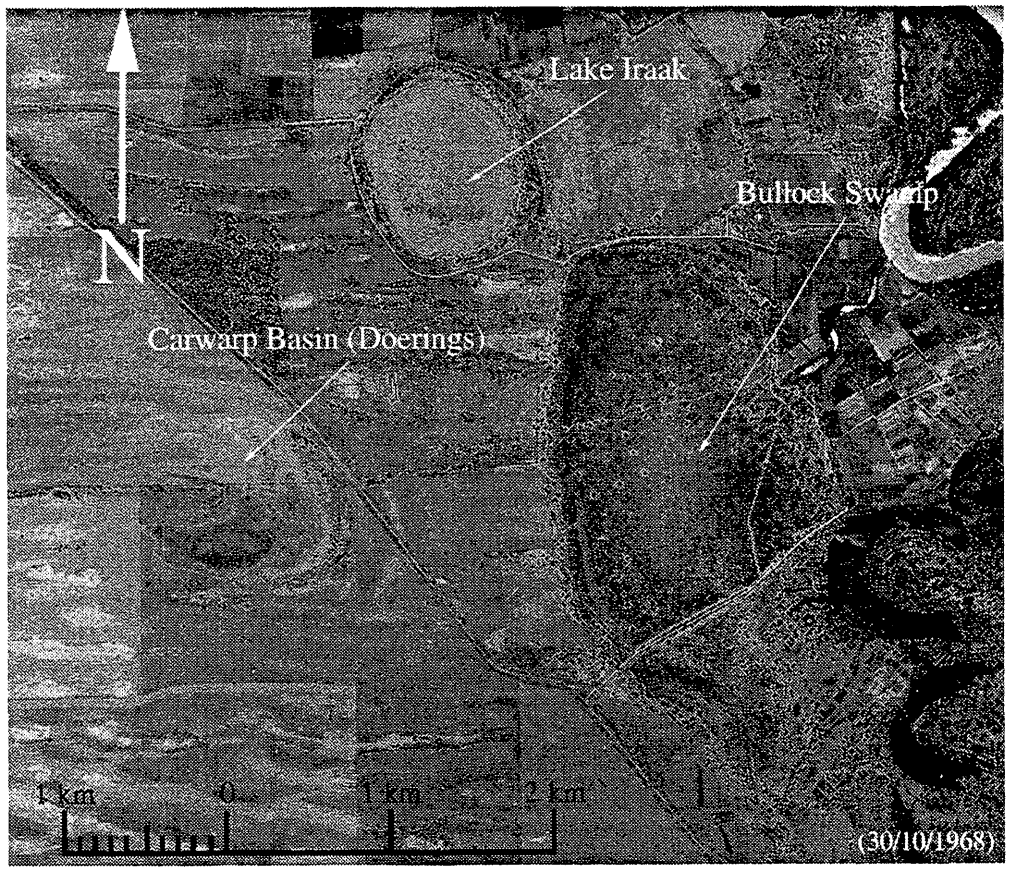
Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Linke, G., and Samarasinghe, N., 1993- Doerings Evaporation Basin Investigation. Nangiloc-Colignan Salinity Management Implementation., Rural Water Corporation, Unpublished report

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


Lake Iraak
Bullock Swamp
N
Carwarp Basin (Doerings)
1 km
0
1 km
2 km
(30/10/1968)

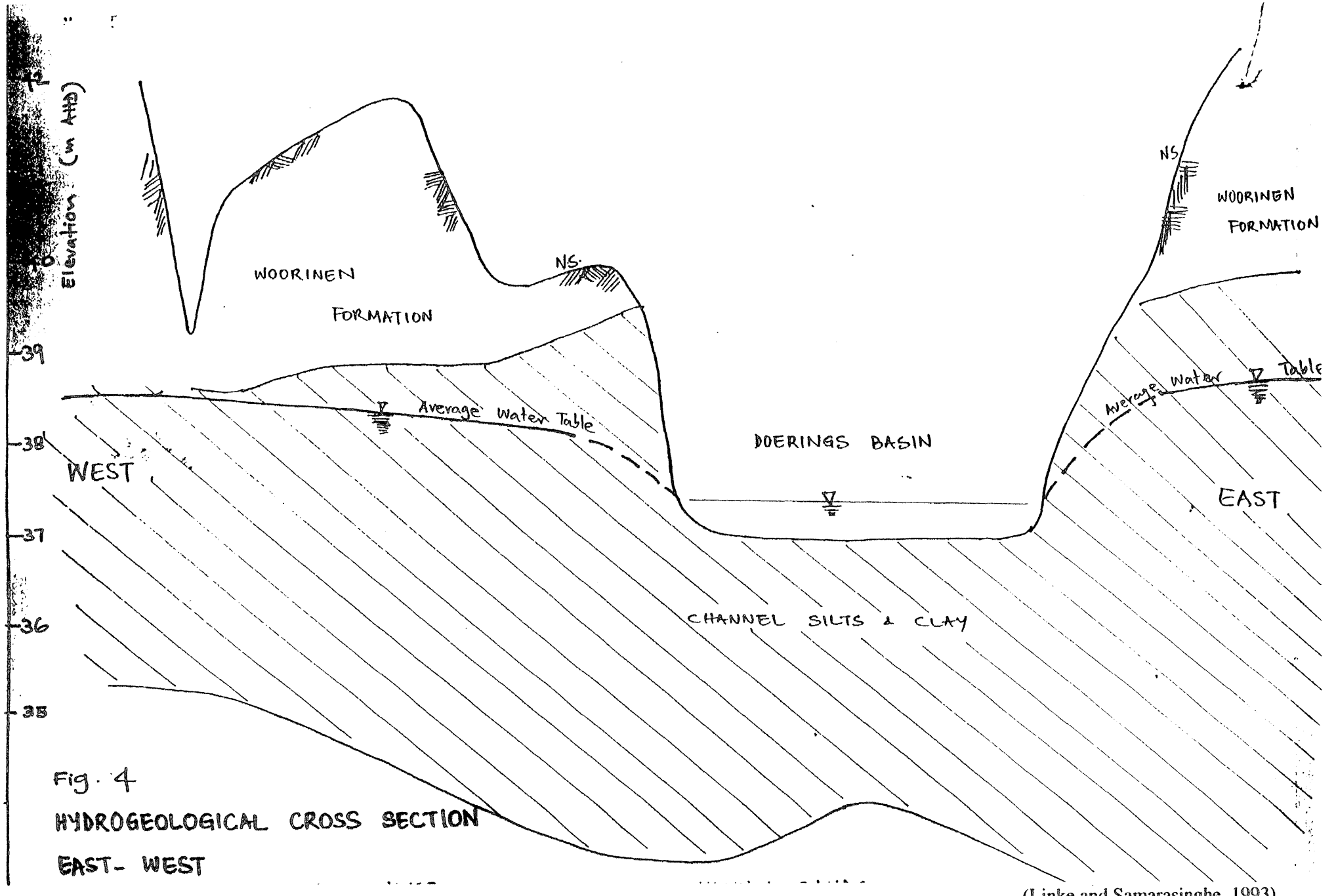


Fig. 4

HYDROGEOLOGICAL CROSS SECTION

EAST- WEST

(Linke and Samarasinghe, 1993)

<Site Name> Castles Crossing
<Synonyms>

Engineering/Admin

<**Public or private operation**> Private

<**Agency responsible**> Landholder

<**Project name**> Castles Crossing

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**>

Geological

<**Site description and Geomorphology**> The basin sits within the trench on the Rufus Terrace. It is located in a depression within the longitudinal Woorinen dunes and shows evidence of being a discharge zone (surface salinisation).

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located within the Raak Trough (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (5-10 m), and is underlain by the Rufus Formation (5 m), the Channel Sand (5-7 m), the Blanchetown Clay (32 m), the Parilla Sand (65 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Rufus Formation and Blanchetown Clay

<**Aquitard lithofacies**> Rufus Formation: Silt and silt clay; Blanchetown Clay: Clay and silt

<**Aquifer**> Channel Sand and Parilla Sand

<**Aquifer lithofacies**> Channel Sand and Parilla Sand: Coarse to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 3 kilometres

<Site Name> Castles Crossing
<Synonyms>

Spatial

<**Location description**> 4 kilometres WNW of Colignan, Victoria and 14 kilometres NE of Nowingi, Victoria

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Nowingi 7328

<**Zone**> 54

<**Coordinates easting (AMG)**> 622900

<**Coordinates northing (AMG)**> 6179500

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 5-10 ha (Estimate, C. Thompson, pers. comm.)

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> 39 m AHD (estimate)

<**Groundwater level (m AHD)**> Channel Sand: 39 m AHD; Parilla Sand: 37.5 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<**Groundwater seepage/discharge**> Discharge

<**Average annual evaporation**> 1980 mm Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**> 110 ML/yr

<**Salinity of water disposed (EC)**> 20,000 EC

<**Range of salinity in basin (EC)**> 25,500 mg/L TDS

<**Sources of water to be disposed**> Tile Drains

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**> Flooding of mallee has occurred.

<Site Name> Castles Crossing
<Synonyms>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Northeast towards the river (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Rufus Formation: 5 metres; Blanchetown Clay: 32 metres

<kv and kh of aquifer> Channel Sands: Kh = 40 m/day (Linke, 1993); Parilla Sand: Kh = 1 m/day (Thorne, Hoxley, and Chaplin, 1990)

<EC of aquifer> > 50,000 mg/L TDS (RWC, 1993); Parilla Sand: 25,000 EC, Channel Sand: 45,000 EC (Thorne, Hoxley, and Chaplin, 1990)

<Porosity of aquifer>

<Thickness of aquifer> Channel Sand: 5-7 metres; Parilla Sand: 65 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> There should be little or no leakage from the basin into the regional aquifer. This is because even with disposal the full level of the basin is at or below the potentiometric surface of the Channel Sand. Second, the amount of disposal water (200 ML/yr) is closely matched by the annual evaporation of 198 ML/yr (1980 mm/yr x 10 ha) limiting the volume of water available for leakage. Lastly, the Rufus Formation isolates the basin limiting infiltration to 0.4 ML/ha/yr (Linke, 1993). However, because inflow does exceed evaporation there is a possibility of leakage into the perched aquifer in the Woorinen Formation.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> Castles Crossing
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

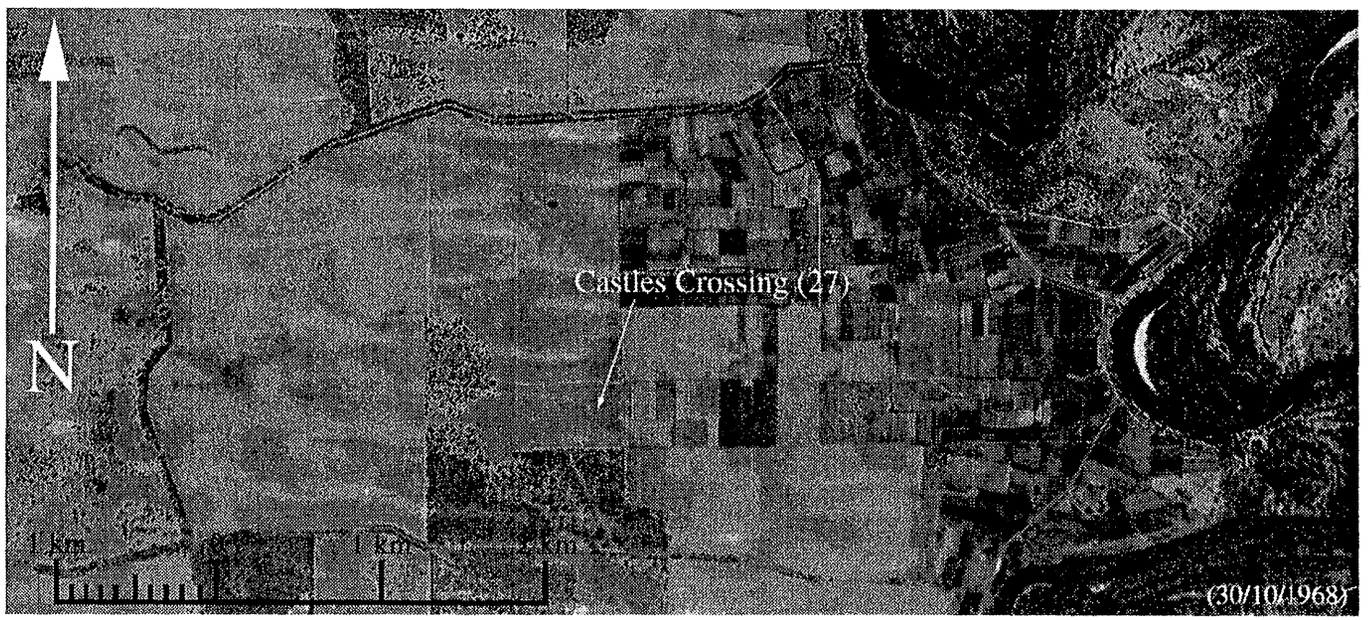
References Cited

Linke, G., 1993- Nangiloc Colignan SMP - Drainage disposal to Karadoc Swamp - CMS Comps., Rural Water Corporation, Unpublished working file No. 93/01895

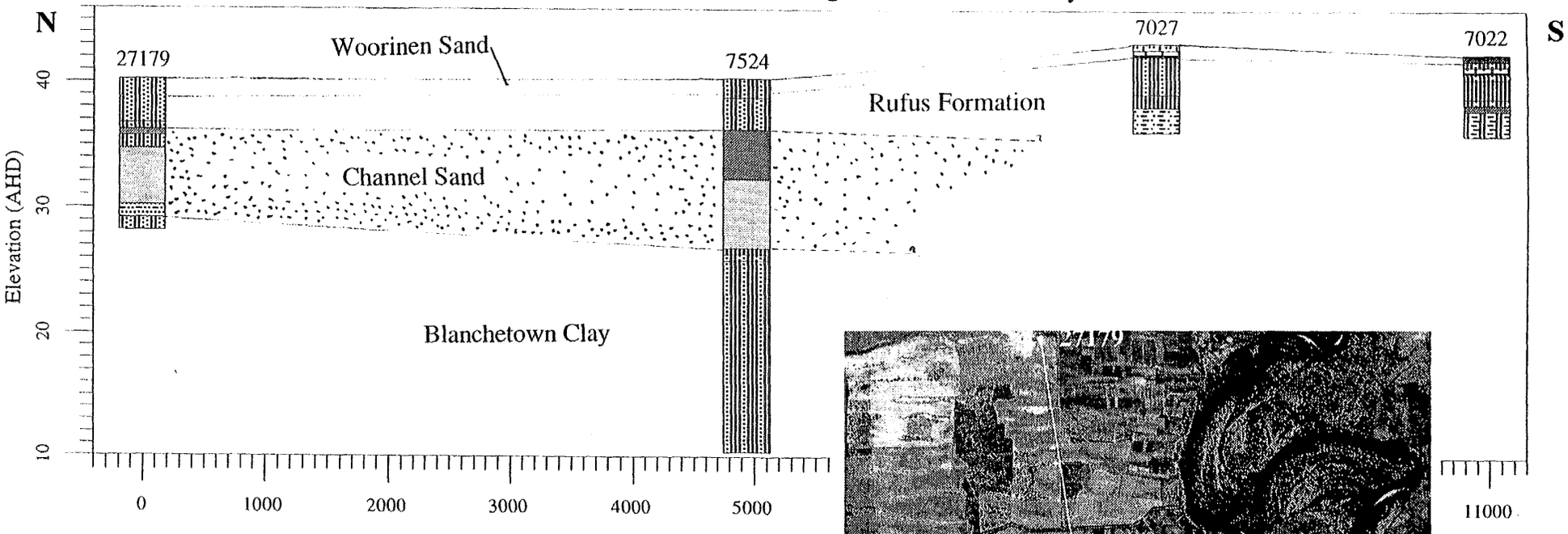
Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

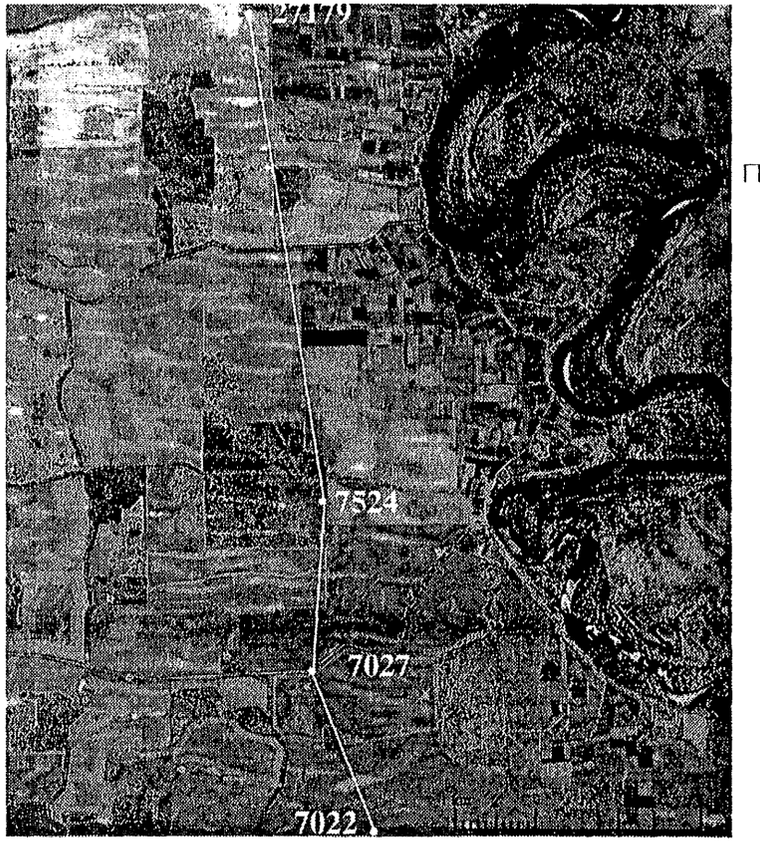
Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
Castles Crossing (27)
1 Km
1 Km
(30/10/1968)

Jacksons-Mat, Castles Crossing, John, and Bothroyd Dick





<Site Name> Coar's Swamp
<Synonyms> Merbein 1

Spatial

<Location description> 9 kilometres SW of Merbein, Victoria and 21 kilometres NW of Red Cliffs, Victoria

<Located in Murray Trench> No

<Location 1:250 000> Mildura

<Location 1:100 000> Mildura 7329

<Zone> 54

<Coordinates easting (AMG)> 592000

<Coordinates northing (AMG)> 6211500

<State> Victoria

General

<Year begun operation> 1973

<Active/inactive> Active

<Full surface area (ha)> 47 ha

<Volume capacity (ML)> 240 ML

<Full surface level (m AHD)> 37 m AHD

<Groundwater level (m AHD)> Parilla Sand: 36-38 m AHD (Thorne, Hoxley, and Chaplin, 1990); Local irrigation mounds within the Woorinen Formation perched aquifer are expected to increase and cause basin discharge (Hoxley, 1991)

<Groundwater seepage/discharge> Discharge from perched aquifer

<Average annual evaporation> Inflow/evaporation > 1.5; 1980 mm/yr Class A pan Red Cliffs

<Volume disposed annually (ML/yr)> 1422 ML/yr

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)> 8800-22,800 EC

<Sources of water to be disposed> Groundwater discharge and tile drainage

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> Coar's Swamp
<Synonyms> Merbein 1

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Commission and First Mildura Irrigation Trust (FMIT)

<**Project name**> Coar's Swamp

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is located in a depression on the Merbein Ridge and is surrounded by cropland and cleared mallee. The basin is complex and appears to have been controlled by preferential deflation of the Blanchetown Clay?, although there is some degree of east-west orientation to the pattern (Woorinen Formation).

<**Subsurface investigations at site**>

<**Structural setting**> The basin is northeast of the Wargan Fault, northwest of the Danyo Fault, and southeast of the Yelta Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Parilla Sand (although there are pedestals of Blanchetown Clay (0-8 m) and a veneer of Woorinen Formation (0-1 m)) (30 m), and underlain by the Bookpurnong Beds, the Murray Group Limestone, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Upper Parilla Sand

<**Host lithofacies**> Sandy clay, silty sand, and/or pisolitic ferruginous duricrust (RWC bore 27153)

<**Aquitard**> Upper Parilla Sand

<**Aquitard lithofacies**> Sandy clay, silty sand, and/or pisolitic ferruginous duricrust (RWC bore 27153)

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Medium to fine sand

<**Comments**>

<Site Name> Coar's Swamp
<Synonyms> Merbein 1

Summary of Hydrodynamics

<Distance to Murray or tributary> 11 kilometres

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Southwest away from the Murray River (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> 3 metres

<kv and kh of aquifer> Parilla Sand: Kh = 1.6 to 58 m/day (Duncan and Linke, 1992)

<EC of aquifer> > 50,000 mg/L TDS (RWC, 1993)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 27 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin receives 1422 ML/yr of tile drainage (fresh water: 2000-3000 EC), which is nearly one and a half times higher than the evaporation capacity (930 ML/yr). In addition, the Parilla Sand discharges into the northeast corner of the basin which acts to increase the salinity of the basin (8000-22,300 EC). The excess drainage disposal water either enters the perched aquifer or discharges back into the Parilla Sand in the south basin.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Site Name> Coar's Swamp
<Synonyms> Merbein 1

<Evaporation surplus> Evaporation 930 ML/yr (1980 mm/yr x 46 ha) while the input is 1422 ML/yr.

Interpretive 2

<Ranking of sustainability>

References Cited

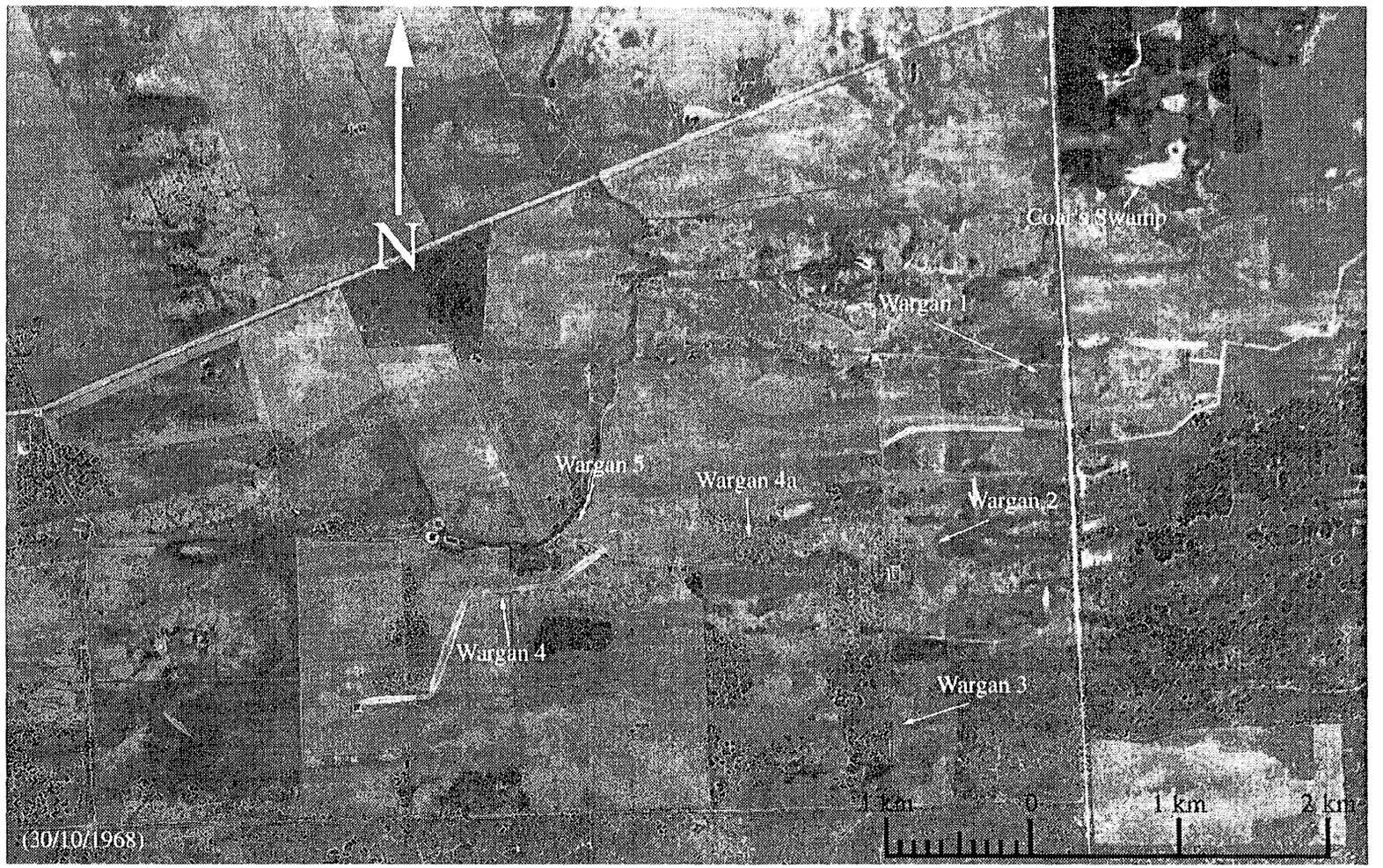
Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

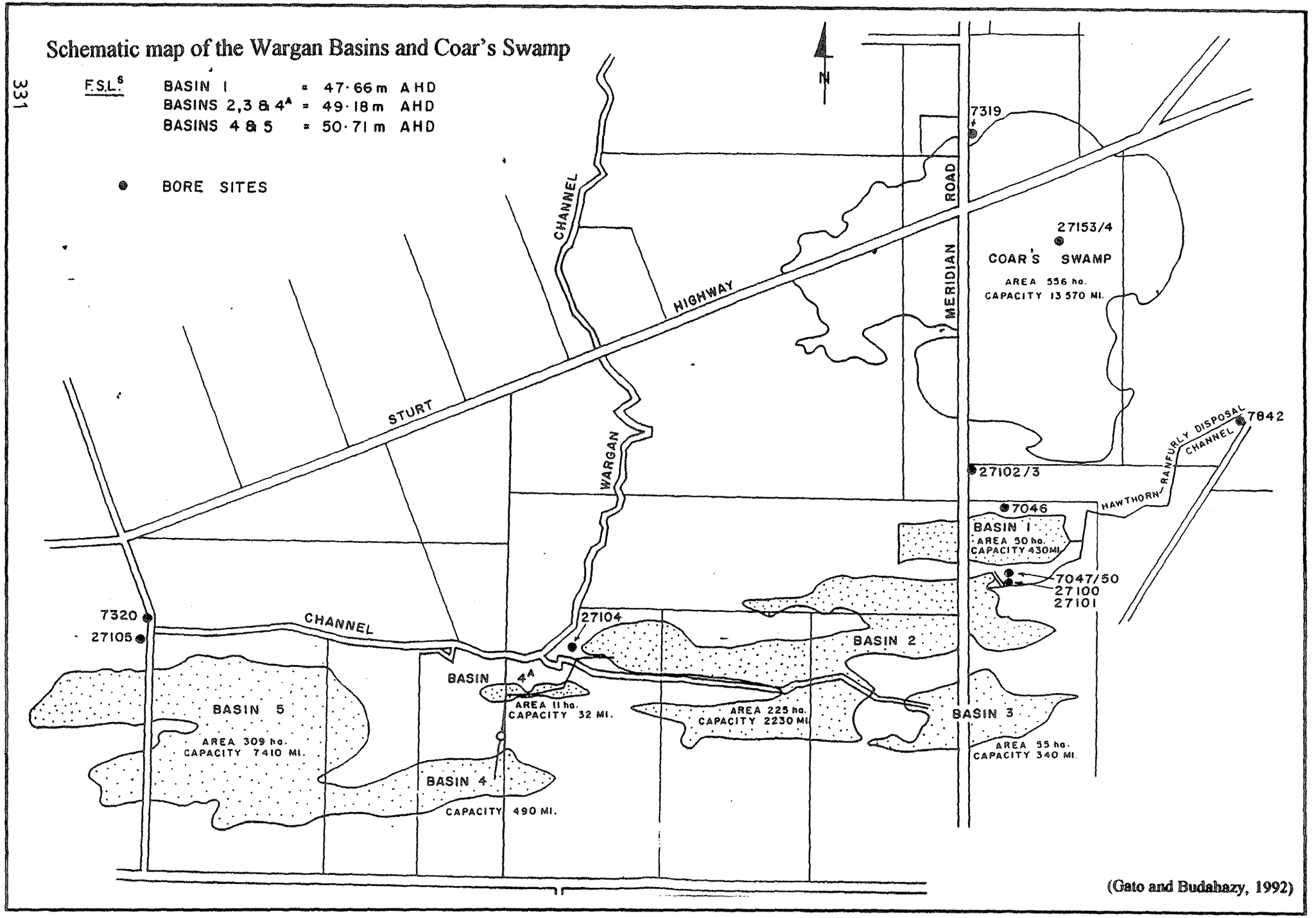
Hoxley, G., 1991- Hydrogeological summary of wetland areas in the Sunraysia Salinity Management Plan Area., Rural Water Corporation, Groundwater Section, Technical note 1

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

R9500406


N
Cobar Swamp
Wargan 1
Wargan 5
Wargan 4a
Wargan 2
Wargan 4
Wargan 3
1 km
0
1 km
2 km
(30/10/1968)



(Gato and Budahazy, 1992)

<Site Name> Colignan
<Synonyms>

Spatial

<Location description> 6.5 kilometres west of Colignan, Victoria and 9 kilometres NE of Nowingi, Victoria

<Located in Murray Trench> Yes

<Location 1:250 000> Mildura

<Location 1:100 000> Nowingi 7328

<Zone> 54

<Coordinates easting (AMG)> 622000

<Coordinates northing (AMG)> 6176500

<State> Victoria

General

<Year begun operation>

<Active/inactive>

<Full surface area (ha)> 10-20 ha (estimated C. Thompson, pers. comm.)

<Volume capacity (ML)>

<Full surface level (m AHD)> 37 m AHD (RWC Map 147161)

<Groundwater level (m AHD)> 38-39 m AHD (RWC, 1991)

<Groundwater seepage/discharge> Discharge

<Average annual evaporation> 1980 mm/yr Class A pan Red Cliffs

<Volume disposed annually (ML/yr)> 200 ML/yr

<Salinity of water disposed (EC)> 1500-5000 EC

<Range of salinity in basin (EC)> Dry

<Sources of water to be disposed> Tile Drains and surface water

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> Colignan
<Synonyms>

Engineering/Admin

<**Public or private operation**> Private

<**Agency responsible**> Landholder

<**Project name**> Colignan

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is located within the trench on the Rufus Terrace. It is in a depression of the longitudinal, east-west trending Woorinen dunes. The mallee around the site has been cleared for agriculture and the there appears to be evidence of deflation (a lunette?) on the eastern margin of the basin.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located within the Raak Trough (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (perhaps some Yamba Formation as well) (5 m), and is underlain by the Rufus Formation (7-10 m), the Channel Sands (Monoman Formation) (5-10 m), the Blanchetown Clay (30 m), the Parilla Sand (65 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Rufus Formation and Blanchetown Clay

<**Aquitard lithofacies**> Rufus Formation: Silt and silt clay; Blanchetown Clay: Clay

<**Aquifer**> Channel Sand and Parilla Sand

<**Aquifer lithofacies**> Channel Sand and Parilla Sand: Medium to coarse sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 8 kilometres

<Site Name> Colignan
<Synonyms>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> WNW away from the river (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard> Rufus Formation: Several order of magnitude less than Channel Sand (Linke, 1990b)

<Thickness of aquitard> Rufus Formation: 7-10 metres; Blanchetown Clay: 25-30 metres

<kv and kh of aquifer> Channel Sand: Kh = 40 m/day (Linke, 1993)

<EC of aquifer> > 50,000 mg/L TDS

<Porosity of aquifer>

<Thickness of aquifer> Channel Sand: 10 m; Parilla Sand: 65 metres

<kv and kh of alluvial aquifer> Kh: 40 m/day (Linke, 1993)

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> There should be little or no leakage from the basin into the Channel Sand aquifer for the following reasons. First, even with disposal the potentiometric surface of the Channel Sand, is higher than full level of the basin. Second, the Rufus Formation is a reasonably good aquitard with groundwater accessions into the Channel Sand estimated to be 0.4 ML/yr/ha (Linke, 1990b). Lastly, the amount of disposal is less than or equal to the amount of disposal (1980 mm/yr evaporation equals 198 ML/yr for 10 ha). However, disposal could enlarge the size of the perched watertable around the basin causing increase salinisation in low lying area near basin.

<Hydraulic linkage to surface runoff> Surface runoff enters the perched watertable.

<Category - hydraulic stability>

<Site Name> Colignan
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

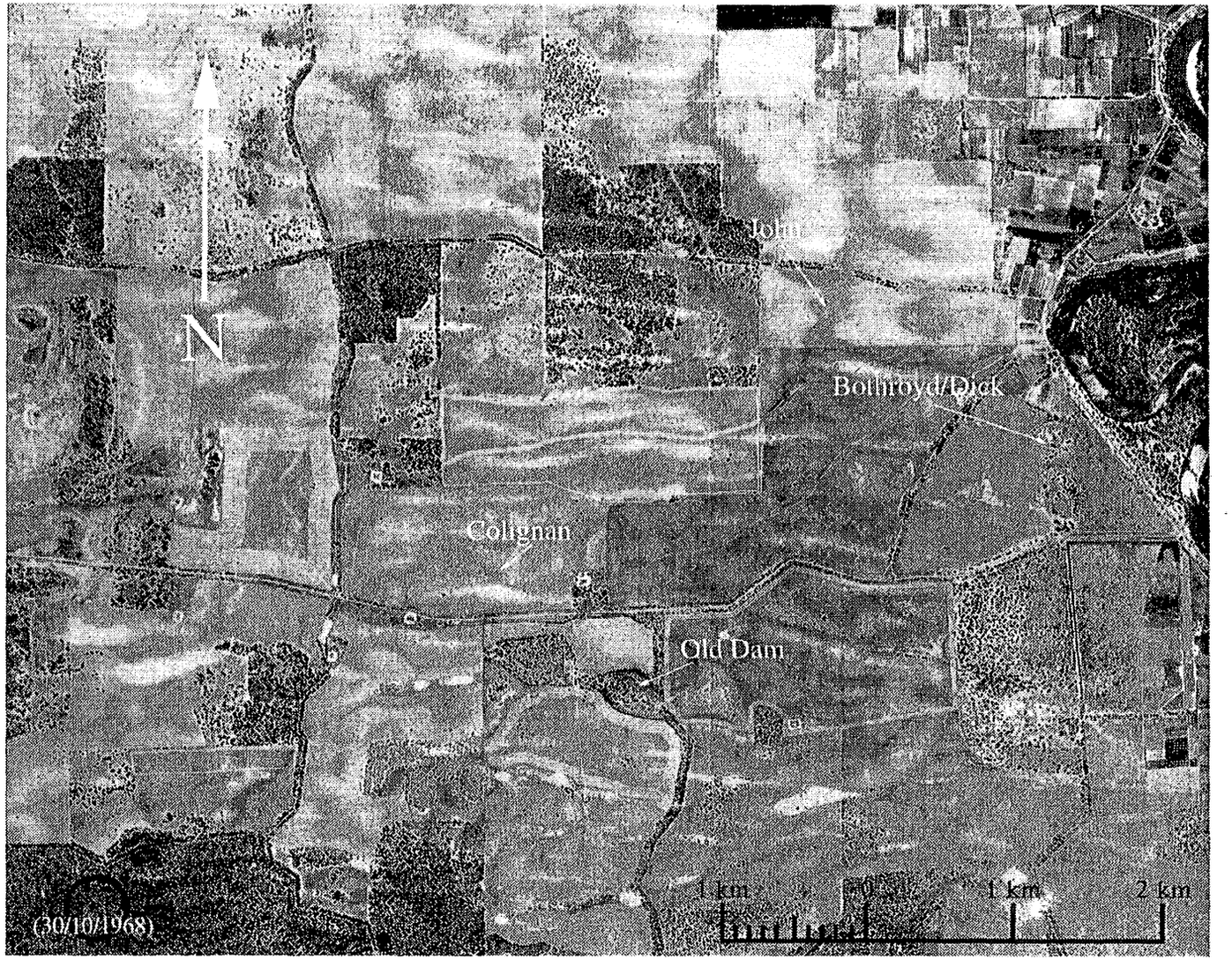
References Cited

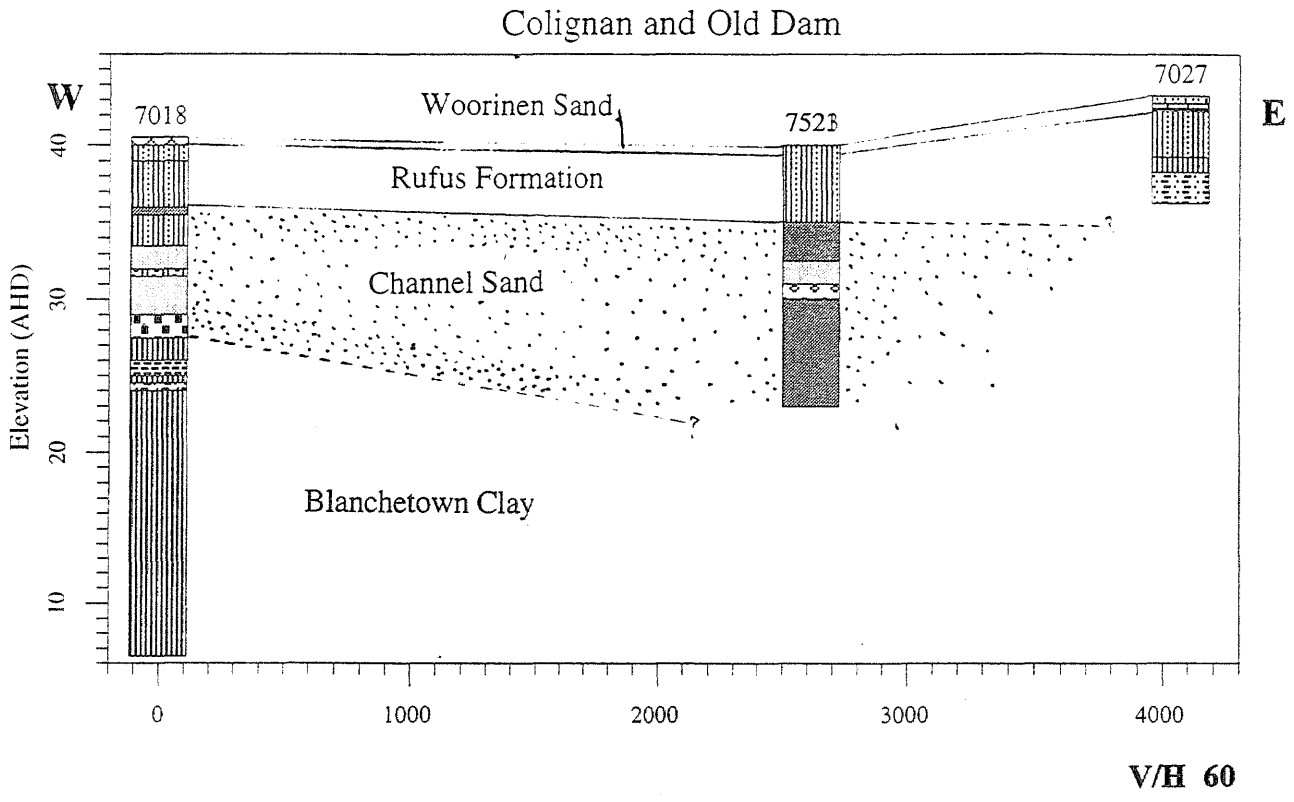
Linke, G., 1993- Nangiloc Colignan SMP Drainage disposal to Karadoc Swamp - CMS Comps., Rural Water Corporation, Unpublished working file No. 93/01895

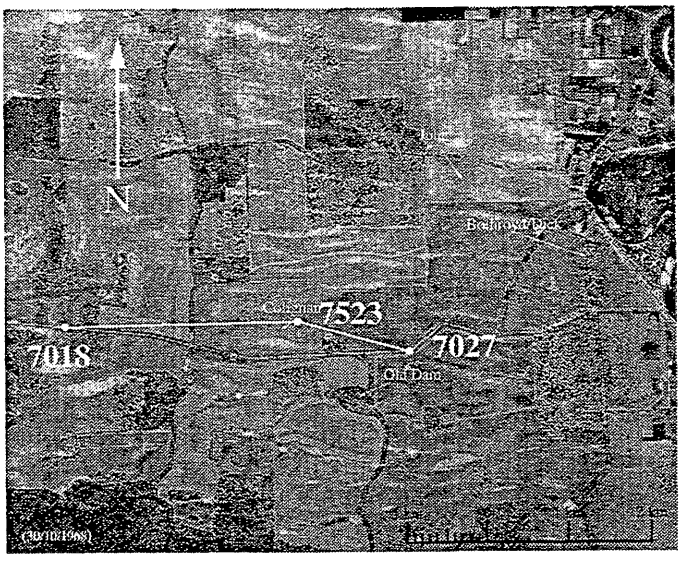
Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
Bolinfoyd/Dick
Colignan
Old Dam
1 km
0
1 km
2 km
(30/10/1968)


Colignan and Old Dam
W
E
7018
7523
7027
Woorinen Sand
Rufus Formation
Channel Sand
Blanchetown Clay
Elevation (AHD)
40
30
20
10
0
1000
2000
3000
4000
V/H 60


N
7018
7523
7027
Old Dam

<Site Name> Collett
<Synonyms>

Spatial

<Location description> 3 kilometres south of Bullock Swamp and 3 kilometres WNW of Nangiloc, Victoria

<Located in Murray Trench> Yes

<Location 1:250 000> Mildura

<Location 1:100 000> Mildura 7329

<Zone> 54

<Coordinates easting (AMG)> 622800

<Coordinates northing (AMG)> 6184400

<State> Victoria

General

<Year begun operation> 1975

<Active/inactive> Active

<Full surface area (ha)> 1.3 ha

<Volume capacity (ML)> 160 ML

<Full surface level (m AHD)> 40 m AHD

<Groundwater level (m AHD)> 38.3 m AHD

<Groundwater seepage/discharge> Seepage

<Average annual evaporation> 1980 mm Class A pan Red Cliffs

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)> 2000 EC

<Range of salinity in basin (EC)> > 200,000 EC (off scale)

<Sources of water to be disposed> Nangiloc North

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> Collett
<Synonyms>

Engineering/Admin

<**Public or private operation**> Private

<**Agency responsible**> Landholder

<**Project name**> Collett

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin sits on the edge of the boundary of the Rufus Terrace and the Coonambidgal Terrace. It is located between two longitudinal Woorinen Dunes and appears to be a natural salina when disposal is not occurring.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located within the Raak Trough (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation, and underlain by the Rufus Formation, the Channel Sand (Monoman Formation), the Blanchetown Clay, the Parilla Sand, the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990 and Brown and Stephenson, 1988).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silts and fine sand

<**Aquitard**> Rufus Formation and Blanchetown Clay

<**Aquitard lithofacies**> Rufus Formation: Silts and clays; Blanchetown Clay: Clay

<**Aquifer**> Channel Sand and Parilla Sand

<**Aquifer lithofacies**> Channel Sand: Medium to coarse sand; Parilla sand: Medium to coarse sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 1 kilometre

<**Head between basin and river/tributary**>

<Site Name> Collett
<Synonyms>

<Direction of groundwater flow in regional aquifer> ENE towards the river (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Rufus Formation: 7-10 metres; Blanchetown Clay: 30 metres

<kv and kh of aquifer> Channel Sand: Kh = 40 m/day (Linke, 1993)

<EC of aquifer> > 50,000 mg/L TDS

<Porosity of aquifer>

<Thickness of aquifer> Channel Sand: 5-10 metres; Parilla Sand: 65 metres (Thorne, Hoxley, and Chaplin, 1990)

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin may act as a discharge zone when it is empty, however when full it seeps. The leakage may cause two potential problems. First, Budahazy and Thompson (1992) have shown that the perched watertable (within the Woorinen Formation and on top of the Rufus Formation) without disposal to be within 0-1 metre of the surface directly beneath the basin, while with disposal the mound increases in size causing potential salinisation to an area about 500 metres around the basin. Second, water that seeps through the Rufus Formation will enter the Channel Sand aquifer which is in direct contact with the River Murray, however any input to the river will be small due to amount of water the basin receives.

<Hydraulic linkage to surface runoff> Surface runoff forms a perched aquifer within the Woorinen Formation.

<Category - hydraulic stability>

<Site Name> Collett
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Brown, C.M., and Stephenson, A.E., 1991- Geology of the Murray Basin, Southeastern Australia., Bureau of Mineral Resources, Geology and Geophysics, BMR Bulletin 235, (Australian Government Publishing Services, Canberra)

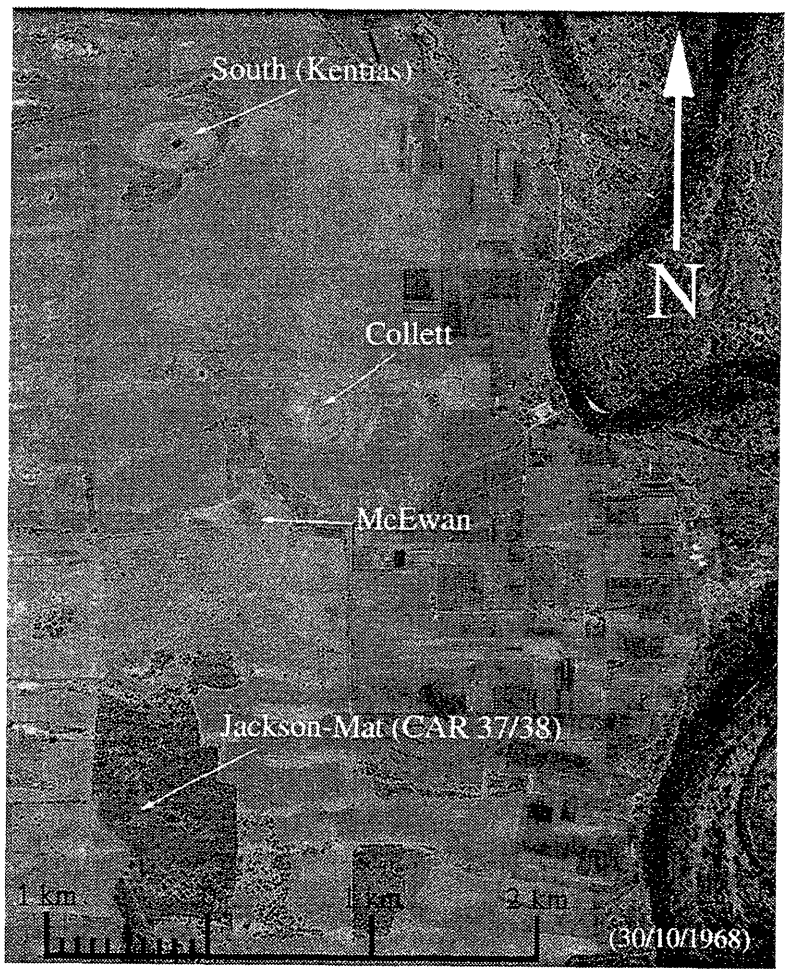
Budahazy, M., and Thompson, M., 1992- Nangiloc-Colignan Salinity Management Plan Investigation of basins for use as drainage disposal basins., Rural Water Corporation, Unpublished report 1992/15

Linke, G., 1994b- Nangiloc-Colignan McEwans, Kentia, and Colletts Basins - Evaporation capacity., Unpublished working file No. 02/00859

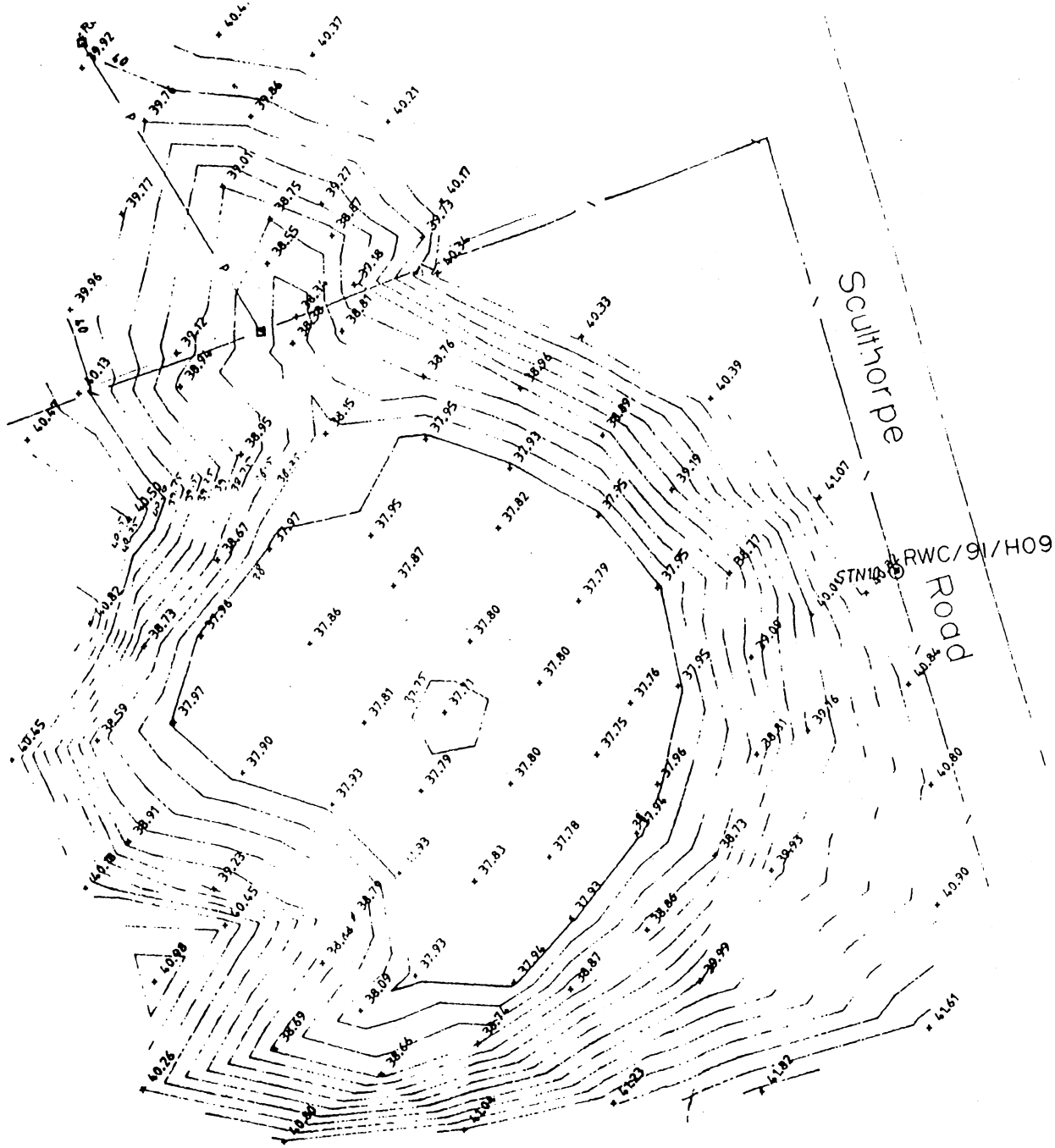
Linke, G., 1993- Nangiloc Colignan SMP - Drainage disposal to Karadoc Swamp - CMS Comps., Rural Water Corporation, Unpublished working file No. 93/01895

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


South (Kentias)
N
Collett
McEwan
Jackson-Mat (CAR 37/38)
1 Km
2 Km
(30/10/1968)

Colletts Basin

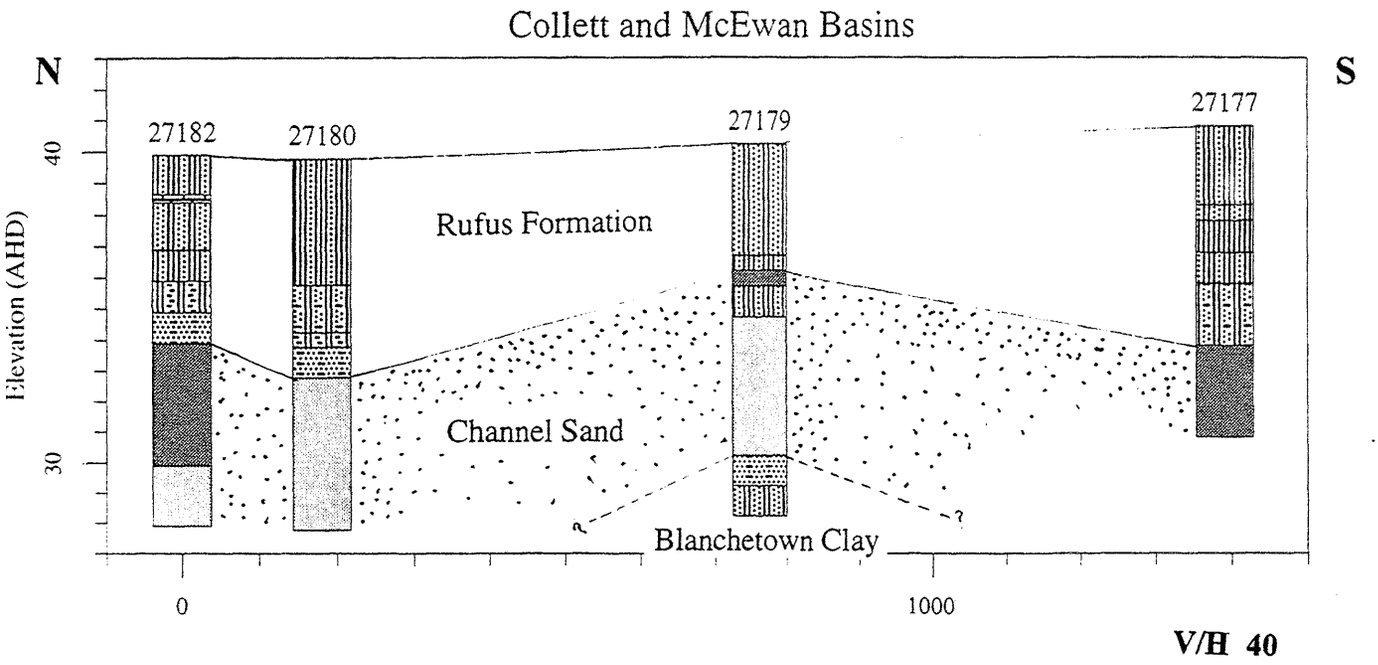


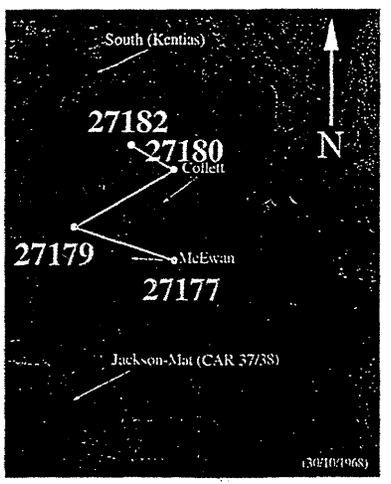
N

Scale 1:20,000 reduced to A4

Parish of Carwarp

(RWC files)


Collett and McEwan Basins
N
S
27182
27180
27179
27177
Rufus Formation
Channel Sand
Blanchetown Clay
Elevation (AHD)
40
30
0
1000
V/H 40


South (Kentlas)
27182
27180
Collett
N
27179
McEwan
27177
Jackson-Mat (CAR 37/38)

<Site Name> Commercial Vehicles Ltd
<Synonyms>

Spatial

<Location description>

<Located in Murray Trench> Yes

<Location 1:250 000>

<Location 1:100 000>

<Zone>

<Coordinates easting (AMG)>

<Coordinates northing (AMG)>

<State> Victoria

General

<Year begun operation>

<Active/inactive>

<Full surface area (ha)> 8 ha

<Volume capacity (ML)>

<Full surface level (m AHD)>

<Groundwater level (m AHD)>

<Groundwater seepage/discharge>

<Average annual evaporation>

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)>

<Sources of water to be disposed> Irrigation discharge

<Terminal/throughflow basin>

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> Commercial Vehicles Ltd
<Synonyms>

Engineering/Admin

<Public or private operation> Private

<Agency responsible>

<Project name> Commercial Vehicles Ltd

<Natural, modified natural or constructed>

<Modification type and degree>

Geological

<Site description and Geomorphology>

<Subsurface investigations at site>

<Structural setting>

<Stratigraphic setting>

<Host formation>

<Host lithofacies>

<Aquitard>

<Aquitard lithofacies>

<Aquifer>

<Aquifer lithofacies>

<Comments>

Summary of Hydrodynamics

<Distance to Murray or tributary>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer>

<kv of artificial floor>

<Site Name> Commercial Vehicles Ltd
<Synonyms>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard>

<kv and kh of aquifer>

<EC of aquifer>

<Porosity of aquifer>

<Thickness of aquifer>

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer>

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

<Site Name> Cowanna Billabong
<Synonyms>

Spatial

<**Location description**> 4 kilometres NW of Merbein, Victoria and 4 kilometres SSW of Dareton, NSW

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7229

<**Zone**> 54

<**Coordinates easting (AMG)**> 595000

<**Coordinates northing (AMG)**> 6222500

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 16 ha (Hoxley, 1991; and Bluml, 1992); Must be larger (C. Thompson, pers. comm.)

<**Volume capacity (ML)**> No survey data

<**Full surface level (m AHD)**> 31-32 m AHD

<**Groundwater level (m AHD)**> 34-35 m AHD

<**Groundwater seepage/discharge**> Discharge

<**Average annual evaporation**> 1980 mm Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**> 35 ML/yr groundwater

<**Salinity of water disposed (EC)**> 33,000 EC groundwater (Saltload 1137 t/yr) (Hoxley, 1991)

<**Range of salinity in basin (EC)**> 6100 EC (Hoxley, 1991)

<**Sources of water to be disposed**> Groundwater discharge from escarpment, throughflow from Brickworks Billabong, and river water (diluting effect)

<**Terminal/throughflow basin**> Throughflow (connected to Murray River by a pipe)

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> Cowanna Billabong
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Commission

<**Project name**> Cowanna Billabong

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Pipe connection to Murray River, the basin was originally used as irrigation storage.

Geological

<**Site description and Geomorphology**> Cowanna Billabong is a stranded meander of the Murray River bounded on the southwest by the trench escarpment and elsewhere by the floodplain. It appears to be on a slightly lower terrace than neighbouring Brickworks Billabong.

<**Subsurface investigations at site**> 3 bores in area (RWC 7444, 7445, 7446)

<**Structural setting**> The basin is on the edge of the Merbein Ridge, with the Yelta Fault to the northwest and the Danyo Fault to the southeast (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Coonambidgal Formation (6-10 m), and underlain by the Channel Sand (Monoman Formation) (10-15 m), the Parilla Sand (30 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Coonambidgal Formation

<**Host lithofacies**> Fine sand, clayey sand, sandy clay, and clay

<**Aquitard**> Coonambidgal Formation and Bookpurnong Beds

<**Aquitard lithofacies**> Coonambidgal Formation: sandy clay and clay; Bookpurnong Beds: silty clay (Thorne, Hoxley, and Chaplin, 1990)

<**Aquifer**> Channel Sand and Parilla Sand (Combined aquifer)

<**Aquifer lithofacies**> Fine to coarse sand

<**Comments**> Historically there was irrigation storage of fresh water from the river. Saline layers at depth ? (Hoxley, G., 1991). Part of Merbein common.

Summary of Hydrodynamics

<**Distance to Murray or tributary**> < 100 metres

<Site Name> Cowanna Billabong
<Synonyms>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> North to northeast towards the river (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Coonambidgal Formation: 6-10 metres

<kv and kh of aquifer> Kh = 10-15 m/day (RWC, 1991)

<EC of aquifer> 20,000 mg/L TDS

<Porosity of aquifer>

<Thickness of aquifer> 40-45 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The Merbein Ridge acts as a major groundwater barrier forcing the Renmark Group to be under artesian pressure. Combined with this is the large (12 metres) irrigation mound beneath Merbein which results in an almost total flushing of the Parilla Sand beneath ridge (Thorne, Hoxley, and Chaplin, 1990). Groundwater flows radially away from the ridge including large volumes into the Murray Trench, part of which is intercepted by Cowanna Billabong. The basin stores the water until it can be flushed by the Murray River and also acts as storage for water from Brickworks Billabong. Problems may arise do to the connection between the Channel Sand and the Parilla Sand allowing groundwater to enter the Murray directly; and because of the high salinities in the basin (>100,000 EC). The connection provides a conduit by which high salinity water may enter the Murray River during periods of low flow when the hydraulic gradient towards the river is greatest.

<Hydraulic linkage to surface runoff> The basin is flooded by the River Murray during high flows and is connected to the Murray River by a pipe at all times.

<Category - hydraulic stability>

<Site Name> Cowanna Billabong
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

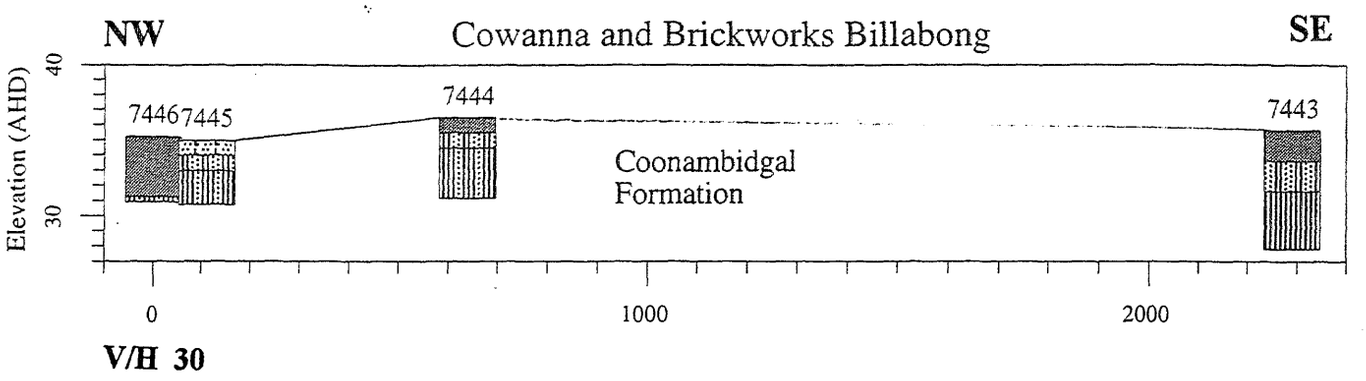
Bluml, M., 1992- Sunraysia Salinity management Plan Environment report., Dept of Conservation and Environment, ISBN 0 7306 2715 2, 103 p.

Hoxley, G., 1991- Hydrogeological summary of wetland areas in the Sunraysia Salinity Management Plan Area., Rural Water Corporation, Groundwater Section, Technical note 1

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
Cowanna Billabong
Hall Dyson
Brickworks Billabong
Lamberts Swamp
1 km
1 km
(30/10/1968)


NW
Cowanna and Brickworks Billabong
SE
Elevation (AHD)
40
30
7446
7445
7444
7443
Coonambidgal
Formation
0
1000
2000
V/H 30


N
Cowanna Billabong
7446
7445
7444
7443
Hall/Dyson
Brickworks Billabong
Lamberts Swamp

<Site Name> Dow Avenue Woodlots
<Synonyms>

Spatial

<Location description> Corner of Dow and Benetook Avenues, 7 kilometres SW of Mildura, Victoria and 10 kilometres NW of Red Cliffs, Victoria

<Located in Murray Trench> No

<Location 1:250 000> Mildura

<Location 1:100 000> Mildura 7329

<Zone> 54

<Coordinates easting (AMG)> 602000

<Coordinates northing (AMG)> 6209800

<State> Victoria

General

<Year begun operation>

<Active/inactive> Active

<Full surface area (ha)> 12 ha

<Volume capacity (ML)>

<Full surface level (m AHD)>

<Groundwater level (m AHD)> 41-42 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<Groundwater seepage/discharge>

<Average annual evaporation> 1980 mm/yr Class A pan Red Cliffs

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)> 2930 mg/L TDS

<Sources of water to be disposed> Groundwater discharge

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> Dow Avenue Woodlots
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> First Irrigation Trust of Mildura (FMIT)

<**Project name**> Dow Avenue Woodlots

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is located in a depression within the uneven surface of the Woorinen dunes. It is surrounded by cleared mallee and cropland, and shows evidence of receiving discharge?.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is northeast of the Wargan Fault and southeast of the Danyo Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (5 m), and is underlain by the Blanchetown Clay (10-12 m), the Parilla Sand (45 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Throne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and the Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay and silty clay; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 7.5 kilometres

<Site Name> Dow Avenue Woodlots
<Synonyms>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Southwest away from the Murray River

<kv of artificial floor>

<kv and kh of host> Woorinen Formation: Kh = 40-50 m/day (Transmissivity 190 m^2/day (SR&WSC, 1974))

<kv and kh of aquitard>

<Thickness of aquitard> Blanchetown Clay: 10-12 metres; Upper Parilla Sand: 5-7 metres

<kv and kh of aquifer> Parilla Sand: Kh = 1.6-58 m/day (Duncan and Linke, 1992)

<EC of aquifer> > 50,000 mg/L TDS (RWC, 1993)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 40 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The salinity of the basin is 2930 mg/L TDS which indicates either that the measurement was taken just after disposal, or that the basin receives water from the perched aquifer in the Woorinen Sand (the only other significant source of fresh water) (RWC, 1993). The water in the perched aquifer flows through the Woorinen Formation and is fed by accession of irrigation water. Most basins that receive discharge from the Woorinen Formation, act as a throughflow basin because of the high volume of water that is fed through the system. Even though the full level of the basin is unknown it probably has the potential to leak into the Parilla Sand because it is located on a high above the surrounding plain.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> Dow Avenue Woodlots
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus> Evaporation capacity 240 ML/yr (12 ha x 1980 mm/yr evaporation)

Interpretive 2

<Ranking of sustainability>

References Cited

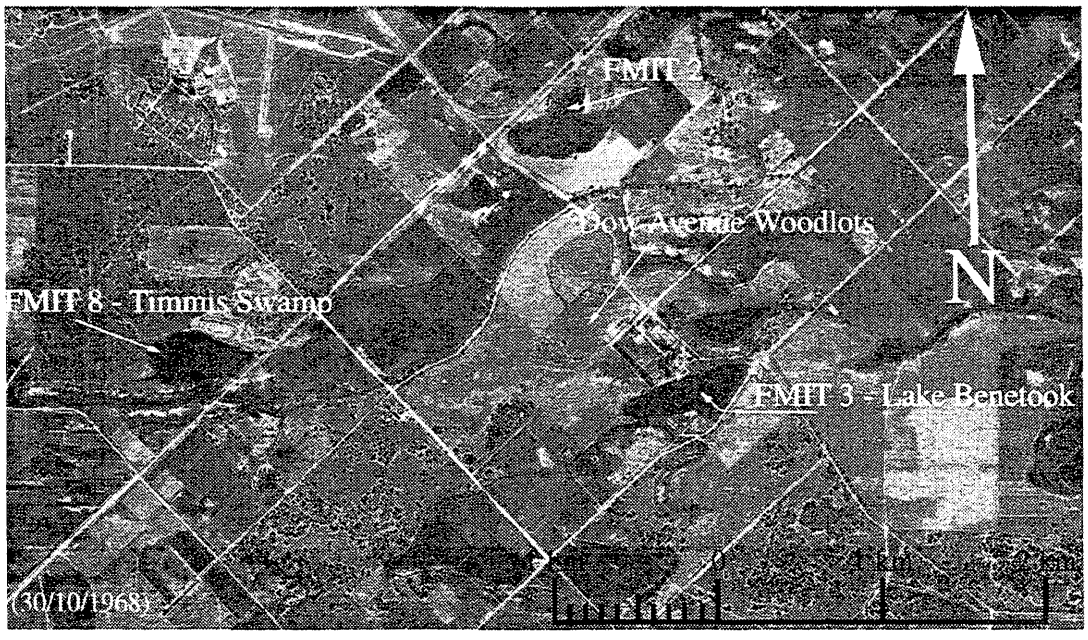
Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

State Rivers and Water Supply Commission, Victoria (SR&WSC), 1974- Sunraysia Salinity Investigations., Unpublished report

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


FMFT 2
Dow Avenue Woodlots
N
FMFT 8 - Timmis Swamp
FMFT 3 - Lake Benetook
(30/10/1968)

<Site Name> Dry Lake
<Synonyms>

Spatial

<Location description> 4 kilometres SE of Kerang, Victoria and 2.5 kilometres north of Kerang South

<Located in Murray Trench> No

<Location 1:250 000> Swan Hill

<Location 1:100 000> Kerang 7626

<Zone> 54

<Coordinates easting (AMG)> 767500

<Coordinates northing (AMG)> 6037000

<State> Victoria

General

<Year begun operation> 1981

<Active/inactive> Inactive

<Full surface area (ha)> 148 ha

<Volume capacity (ML)> 2124 ML

<Full surface level (m AHD)> 77.1 m AHD

<Groundwater level (m AHD)> 77.0 m AHD (O'Rourke, 1992)

<Groundwater seepage/discharge> Discharge

<Average annual evaporation> Inflow/evaporation < 0.2

<Volume disposed annually (ML/yr)> 50 ML/yr

<Salinity of water disposed (EC)> 45,000 EC

<Range of salinity in basin (EC)> Dry

<Sources of water to be disposed> Tile Drainage Experiment

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts> Being considered as a disposal site for Pyramid Creek Groundwater Interception Scheme. More information will be known as investigations progress. Due for completion 1995/96. Contact Geoff Linke, RWC Investigations.

<Site Name> Dry Lake
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Pyramid Creek Groundwater Interception Scheme

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> Dry Lake is located in a NNW-SSE trending deflation basin that is bounded on the east by a lunette and also shows evidence of salt accumulation (air photos). It is surrounded by farmland and is between Pyramid Creek and the Loddon River.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located east of the Leaghur Fault within the Yando Trough, and south of the Gannawarra Graben (Pratt, 1988).

<**Stratigraphic setting**> The basin is floored by the Yamba Formation (1-2 m), and underlain by the Shepparton Formation (25-30 m), the Parilla Sand (60 m), and the Renmark Group (Geology interpreted from Pratt, 1988).

<**Host formation**> Yamba Formation

<**Host lithofacies**> Clay, salt and lunettes

<**Aquitard**> Shepparton Formation

<**Aquitard lithofacies**> Clays and silts

<**Aquifer**> Shepparton Formation and Parilla Sand

<**Aquifer lithofacies**> Shepparton Formation: Isolated sand bodies amid clays and silts; Parilla Sand: Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 3.5 kilometres to Pyramid Creek

<**Head between basin and river/tributary**>

<Site Name> Dry Lake
<Synonyms>

<Direction of groundwater flow in regional aquifer> North to northwest towards the Pyramid Creek and the Murray River (O'Rourke, 1992).

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Shepparton Formation: 25 metres

<kv and kh of aquifer> Parilla Sand: 60% sand (Pratt, 1988)

<EC of aquifer> Parilla Sand: >50,000 mg/L TDS (RWC, 1993a); Parilla Sand: 12,000 mg/L TDS (Pratt, 1988)

<Porosity of aquifer>

<Thickness of aquifer> Shepparton Formation: Variable depending on the presence or absence of sand bodies; Parilla Sand: 60 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin has partially deflated through the Shepparton Formation due to historical discharge from the Parilla Sand. Presently, the potentiometric head within the Parilla Sand is at or slightly below the full level of the basin, which means that depending on the season the basin may receive discharge or seep into the Parilla Sand. Seepage rates are controlled by the thickness and permeability of the Shepparton Formation, the amount of water in the basin, and the groundwater level of the Parilla Sand. The thickness of the Shepparton Formation beneath the basin is about 25 metres, although 3 kilometres away in Pyramid Creek the Parilla Sand is exposed. The permeability of the Shepparton Formation should be low, unless there is a prior sand body nearby, however there is no data to suggest that a lens is present. The volume of water available to enter the Parilla is low because of the high evaporation rates (greater than 5 times inflow), which will limit the impact of seepage. Seepage that does enter the Parilla Sand will flow northwards and discharge into Pyramid Creek and into the Murray River. However, there is a program in place to intercept water entering Pyramid Creek which should alleviate potential problems.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> Dry Lake
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

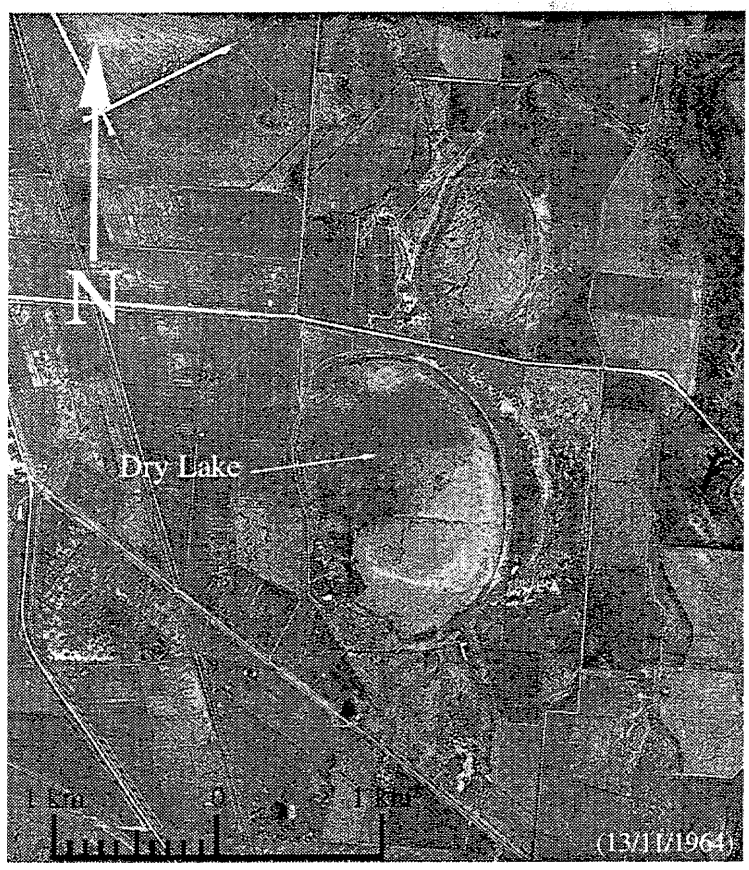
<Ranking of sustainability>

References Cited

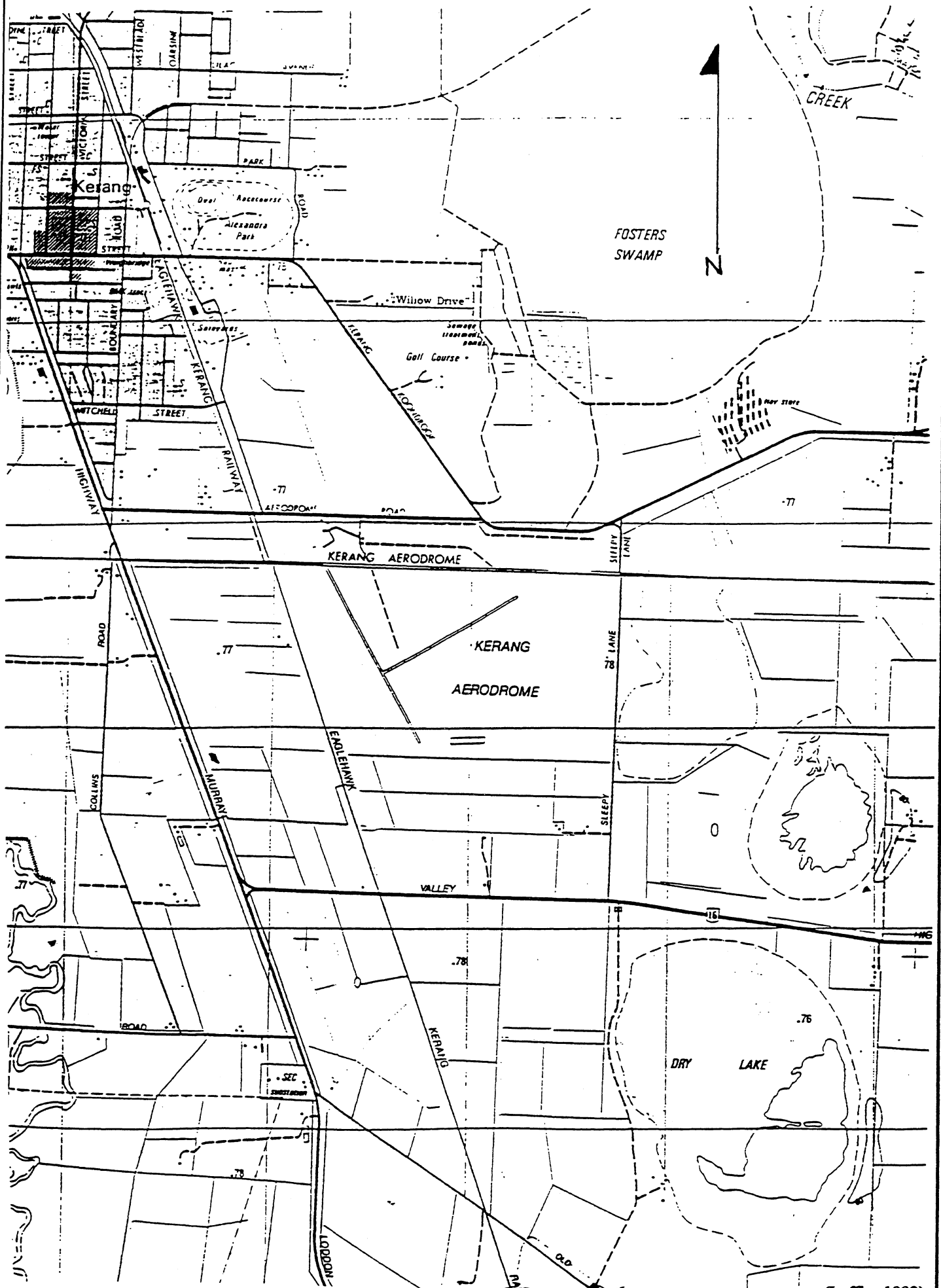
O'Rourke, M.E., et. al, Victorian Rural Water Commission, 1992- Swan Hill Hydrogeological Map (1:250,000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra Australia

Pratt, M.C., 1988- Hydrogeological assessment of the Loddon and Avoca Plains., Department of Water Resources, Victoria, Unpublished report

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.


N
Dry Lake
1 km
0
1 km
(13/11/1964)

Dry Lake



(Laffin, 1992)

<Site Name> FMIT 1
<Synonyms> Rifle Butts Swamp

Spatial

<Location description> 1 kilometre east of Lake Ranfurly East and 1 kilometre west of Mildura, Victoria

<Located in Murray Trench> Yes

<Location 1:250 000> Mildura

<Location 1:100 000> Mildura 7329

<Zone> 54

<Coordinates easting (AMG)> 605000

<Coordinates northing (AMG)> 6216500

<State> Victoria

General

<Year begun operation>

<Active/inactive> Active

<Full surface area (ha)> 20 ha

<Volume capacity (ML)> 40 ML

<Full surface level (m AHD)> 35.7 m AHD

<Groundwater level (m AHD)> 36 m AHD

<Groundwater seepage/discharge> Discharge

<Average annual evaporation> 1980 mm/yr Class A pan Red Cliffs

<Volume disposed annually (ML/yr)> 39.1 ML/yr

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)> 3700-13420 EC

<Sources of water to be disposed> Groundwater/ Drainage

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts> Some urban drainage into basin

<Site Name> FMIT 1
<Synonyms> Rifle Butts Swamp

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> First Mildura Irrigation Trust (FMIT)

<**Project name**> FMIT 1 Rifle Butts Swamp

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**>

Geological

<**Site description and Geomorphology**> FMIT 1 is located in the trench, on the Rufus Terrace, approximately 7 metres above the level of the river. It is bounded on the west by Lake Ranfurly's lunette and on the east by the trench escarpment.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located in the Koorlong Trough south east of the Danyo Fault (Thorn, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Rufus Formation (3-5 m), and is underlain by the Channel Sand (4 m), the Parilla Sand (20-30 m), the Bookpurnong Beds, the Murray Group Limestone, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990, RWC bores, and Cox, 1989).

<**Host formation**> Rufus Formation

<**Host lithofacies**> Clay and silts

<**Aquitard**> Rufus Formation and Upper Parilla Sand

<**Aquitard lithofacies**> Rufus Formation: clays and silts; Upper Parilla Sand: Pisolitic, ferruginous duricrust and/or clay (Cox, 1989)

<**Aquifer**> Channel Sand and Parilla Sand

<**Aquifer lithofacies**> Parilla Sand: Fine to coarse sand; Channel Sand: Coarse to medium sand, typically 50% coarse, 36% medium, and 8-10 % fine sand, silt and clay (Cox, 1989)

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 1.5 kilometres

<Site Name> FMIT 1
<Synonyms> Rifle Butts Swamp

<Head between basin and river/tributary> 7 metres

<Direction of groundwater flow in regional aquifer> Northwest towards the river (RWC, 1991)

<kv of artificial floor>

<kv and kh of host> Rufus Formation: Kv = 5 x 10^{-8} to 5 x 10^{-6} m/day; Kh = 0 m/day (Narayan and Armstrong, 1993)

<kv and kh of aquitard> Rufus Formation: Kv = 5 x 10^{-8} to 5 x 10^{-6} m/day; Kh = 0 m/day (Narayan and Armstrong, 1993)

<Thickness of aquitard> Rufus Formation: 3-6 metres; Upper Parilla Sand: 2-4 metres

<kv and kh of aquifer> Parilla Sand: Kh = 5 m/day (Narayan and Armstrong, 1993)

<EC of aquifer> >50,000 mg/L TDS; Channel Sand: 3,000-40,000 EC; Parilla Sand: <60,000 EC; Groundwater at Lake Ranfurly: 140,000 EC (Cox, 1989)

<Porosity of aquifer> 0.30 (Narayan and Armstrong, 1993)

<Thickness of aquifer> Channel Sand: 4 metres; Parilla Sand: 30 metres

<kv and kh of alluvial aquifer> Channel Sand: Kh = 25 m/day (Narayan and Armstrong, 1993)

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The groundwater mound beneath Mildura has raised the watertable by over 12 metres and has caused discharge to occur along the southern and eastern margin of the basin. Along the northwestern boundary of the lake, the water table has dropped below the level of the lake allowing seepage into the Channel Sands. The Rufus Formation is a good aquitard with a permeability of 5 x 10^{-8} to 5 x 10^{-6} m/day. However Cox (1989), demonstrated that Lake Ranfurly leaks at a rate of 360 ML/year which suggests that the seal is somewhat variable, opening the possibility of contamination of the Channel Sands. Groundwater in the Channel Sands is intercepted by the Mildura-Merbein Groundwater Interception Scheme and then disposed into Lake Ranfurly. So even if the basin does leak the saline water should not reach the Murray River. However, problems of contamination could arise due to windows in the Upper Parilla Aquitard, where the Channel Sand and Parilla Sand are in contact which may allow the highly saline water to enter the regional aquifer (Cox, 1989 ; Narayan and Armstrong, 1993)

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> FMIT 1
<Synonyms> Rifle Butts Swamp

<Category - degree of hydraulic isolation>

<Evaporation surplus> Inflow/evaporation = 0.16

Interpretive 2

<Ranking of sustainability>

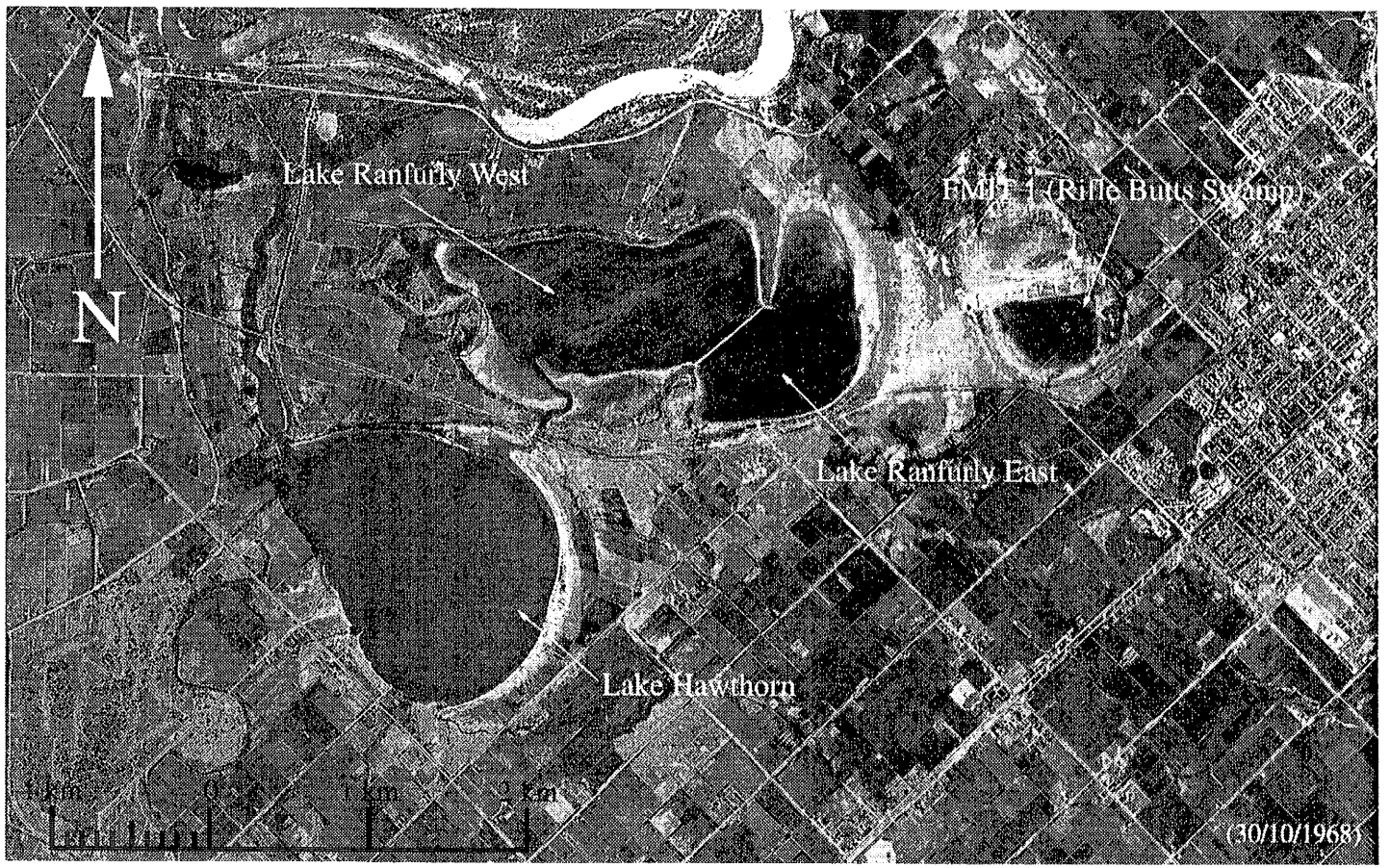
References Cited

Cox, F., 1989- Mildura-Merbein Groundwater Interception Scheme north of Lake Ranfurly redesign of pumping bores., Rural Water Corporation Unpublished report 1989/28

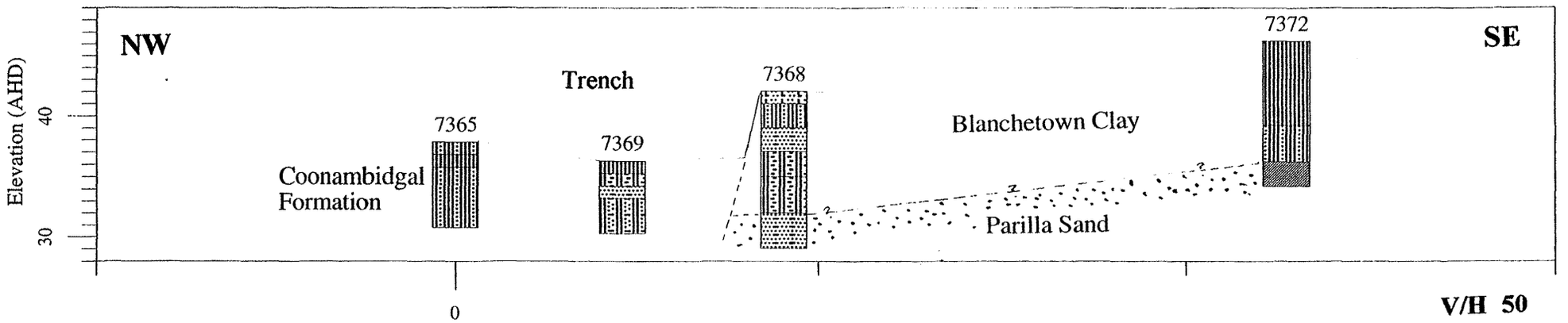
Narayan, K., and Armstrong, D., 1993- Simulation of groundwater interception at Lake Ranfurly, Victoria, incorporating variable density flow and solute transport., Centre for Groundwater Studies, Report 52

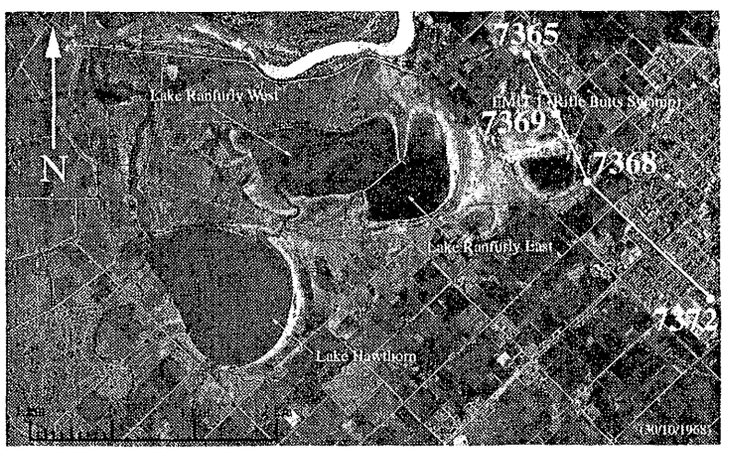
Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

State Rivers and Water Supply Commission, Victoria (SR&WSC), 1974- Sunraysia Salinity Investigations., Unpublished report


N
Lake Ranfurly West
FMU 1 (Rifle Butts Swamp)
Lake Ranfurly East
Lake Hawthorn
1 km
0 1 2 km
(30/10/1968)

FMIT 1 - Rifle Butts Swamp





<Site Name> FMIT 2
<Synonyms>

Spatial

<**Location description**> 8 kilometres SW of Mildura, Victoria and 9 kilometres SSE of Merbein, Victoria along the Sturt Highway

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 601700

<**Coordinates northing (AMG)**> 6211300

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 2.5 ha

<**Volume capacity (ML)**> 1.3 ML

<**Full surface level (m AHD)**> 42.3 m AHD

<**Groundwater level (m AHD)**> 43 m AHD

<**Groundwater seepage/discharge**> Discharge

<**Average annual evaporation**> 1980 mm/yr Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**> 150 ML/yr (Capacity is 1.3 ML)

<**Salinity of water disposed (EC)**>

<**Minimum salinity in basin (EC)**> Dry as of April/May 1992

<**Sources of water to be disposed**> Groundwater and Drainage

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> FMIT 2
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> First Mildura Irrigation Trust (FMIT)

<**Project name**> FMIT 2

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**>

Geological

<**Site description and Geomorphology**> The basin is located in a depression among the uneven surface of the Woorinen Formation. It is surrounded by irrigated land and is near the edge of the trench escarpment.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located within the Koorlong Trough, northeast of the Wargan Fault, and southeast of the Danyo Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (4 m), and is underlain by the Blanchetown Clay (13 m), The Parilla Sand (40 m), the Bookpurnong beds, the Murray Group, and the Renmark Group (Geology interpreted from Throne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay and silty clay; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 6 kilometres

<Site Name> FMIT 2
<Synonyms>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Southwest away from the Murray River (RWC, 1991)

<kv of artificial floor>

<kv and kh of host> Woorinen Formation: Kh = 40-50 m/day (Transmissivity 190 m^2/day) (SR&WSC, 1974)

<kv and kh of aquitard>

<Thickness of aquitard> Blanchetown Clay: 13 metres; Upper Parilla Sand: 5-7 metres

<kv and kh of aquifer> Parilla Sand: Kh = 1.6 to 58 m/day (Duncan and Linke, 1992)

<EC of aquifer> >50 000 mg/L TDS

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 35 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin has the potential to receive discharge from the Parilla Sand because of the high potentiometric head within the Parilla Sand (due to accession of irrigation excess into the aquifer beneath the Mildura-Merbein Irrigation Area). The amount of discharge is unknown, but it should be low because of the thick aquitard (18 m) separating the basin and the Parilla, the relatively low differential in full level and Parilla potential (0.7 m). The issue is further clouded because the basin is usually dry even though it receives 150 ML/yr of tile drainage and the evaporation capacity is only 50 ML/yr (the holding volume is 1.3 ML) (RWC, 1993). Either the amounts of discharge and/or the size of the basin is incorrect, disposal has ceased (for a long time), or that the water in the basin is escaping into the perched aquifer in the Woorinen Formation.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> FMIT 2
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus> Evaporation capacity 50 ML/yr (2.5 ha x 1980 mm/yr) while input equals 150 ML/yr.

Interpretive 2

<Ranking of sustainability>

References Cited

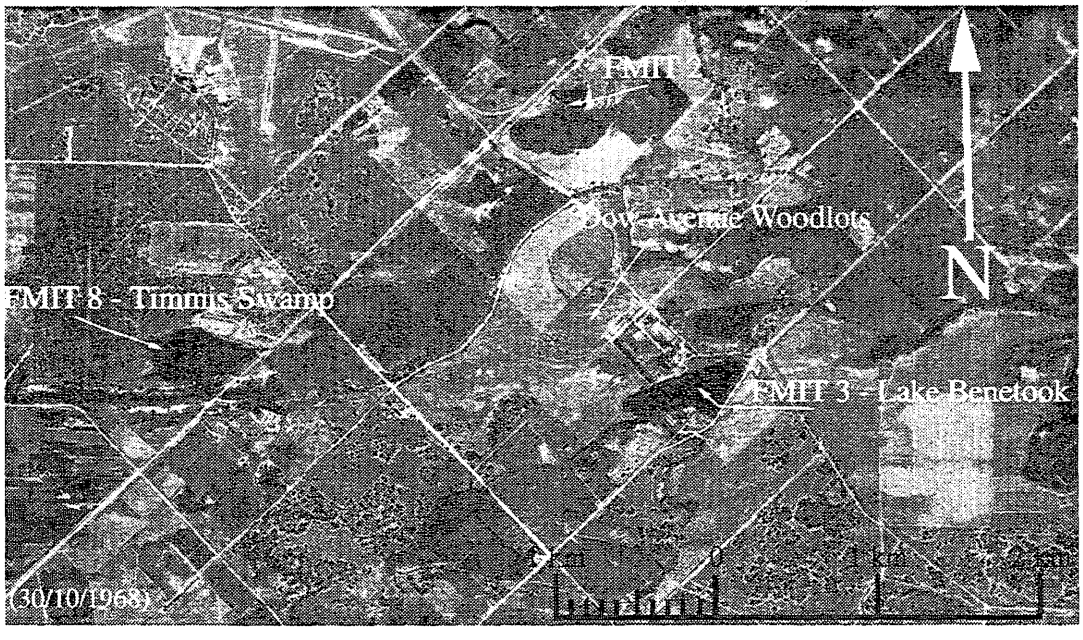
Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

State Rivers and Water Supply Commission, Victoria (SR&WSC), 1974- Sunraysia Salinity Investigations., Unpublished report

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


FMIT 2
Dow-Avenue Woodlots
N
FMIT 8 - Timmis Swamp
FMIT 3 - Lake Benetook
(30/10/1968)

<Site Name> FMIT 3
<Synonyms>

Spatial

<**Location description**> Corner of Dow and Benetook Avenues, 7 kilometres SW of Mildura, Victoria and 10 kilometres NW of Red Cliffs, Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 602600

<**Coordinates northing (AMG)**> 6209800

<**State**> Victoria

General

<**Year begun operation**> Used as irrigation storage

<**Active/inactive**> Inactive

<**Full surface area (ha)**> 3 ha

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**>

<**Groundwater level (m AHD)**> 42 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<**Groundwater seepage/discharge**> Seepage and Discharge

<**Average annual evaporation**> 1980 mm/yr Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**>

<**Minimum salinity in basin (EC)**> Dry

<**Sources of water to be disposed**>

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> FMIT 3
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Commission

<**Project name**> FMIT 3 Lake Benetook

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**>

Geological

<**Site description and Geomorphology**> The basin is located in a depression among the longitudinal Woorinen dunes and is surrounded by cleared mallee.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is southeast of the Danyo Fault and northeast of the Wargan Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (5 m), and underlain by the Blanchetown Clay (13 m), the Parilla Sand (40 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: clay and silty clay; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**> Relift pumps currently preventing water from entering basin

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 8 kilometres

<**Head between basin and river/tributary**>

<Site Name> FMIT 3
<Synonyms>

<Direction of groundwater flow in regional aquifer> Southwest away from the Murray River (RWC, 1991).

<kv of artificial floor>

<kv and kh of host> Woorinen Formation: Kh = 40-50 m/day (Transmissivity 190 m^2/day (SR&WSC, 1974))

<kv and kh of aquitard>

<Thickness of aquitard> Blanchetown Clay: 13 metres; Upper Parilla Sand: 5-7 metres

<kv and kh of aquifer> Parilla Sand: Kh = 1.6 to 58 m/day (Duncan and Linke, 1992)

<EC of aquifer> >50 000 mg/L TDS (RWC, 1993)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 35 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Currently, water is being prevented from entering the basin due to a relift pump so that the lake can store irrigation water. The full level of the basin is unknown, but because of the high potential of the area (due to irrigation excess) it may receive discharge from either the perched aquifer (Woorinen Sand) or the Parilla Sand, . However, the amount is small because without drainage disposal the basin is dry. Depending on the level of the basin seepage into the perched aquifer may also be possible because of the high hydraulic conductivity of the aquifer. Seepage into the Parilla Sand, is less likely because the head differential would be low and it is separated from the basin by a thick aquitard (18 m).

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Site Name> FMIT 3
<Synonyms>

<**Evaporation surplus**> Evaporation capacity 59.4 ML/yr (3 ha x 1980 mm/yr evaporation potential)

Interpretive 2

<**Ranking of sustainability**>

References Cited

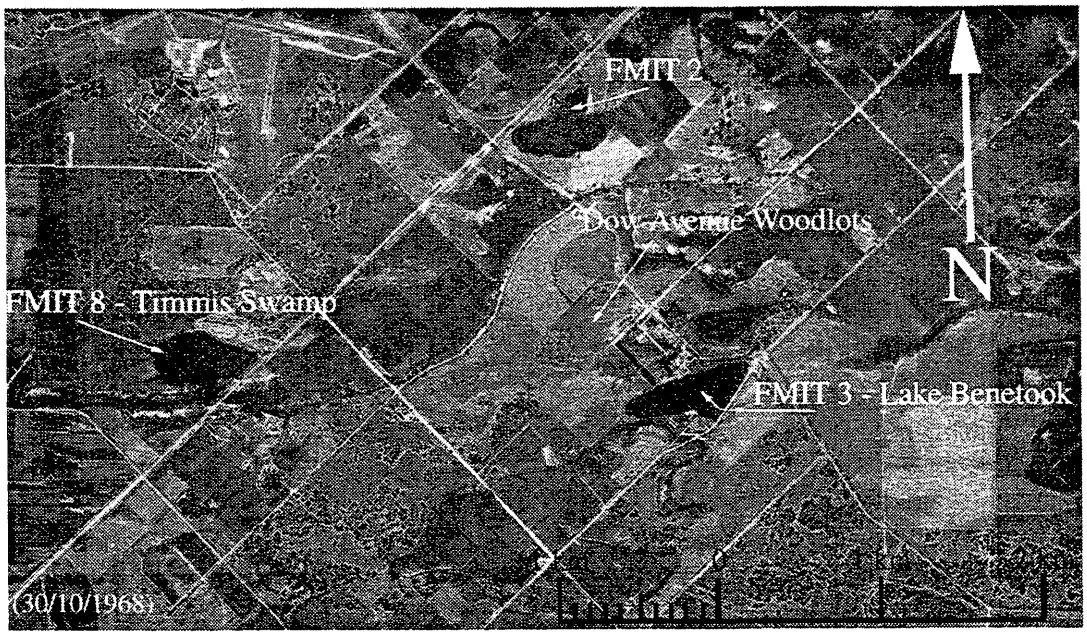
Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

State Rivers and Water Supply Commission, Victoria (SR&WSC), 1974- Sunraysia Salinity Investigations., Unpublished report

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


FMIT 2
Dow Avenue Woodlots
N
FMIT 8 - Timmis Swamp
FMIT 3 - Lake Benetook
(30/10/1968)

<Site Name> FMIT 4
<Synonyms> RWC 10 and RWC 11

Spatial

<Location description> Sandilong Avenue, 10 kilometres SSW of Mildura, Victoria and 8 kilometres NW of Red Cliffs

<Located in Murray Trench> No

<Location 1:250 000> Mildura

<Location 1:100 000> Mildura 7329

<Zone> 54

<Coordinates easting (AMG)> 601500

<Coordinates northing (AMG)> 6207000

<State> Victoria

General

<Year begun operation>

<Active/inactive> Active

<Full surface area (ha)> 34 ha

<Volume capacity (ML)> 352 ML

<Full surface level (m AHD)> 45.82 m AHD

<Groundwater level (m AHD)> 39.5 m AHD

<Groundwater seepage/discharge> Seepage

<Average annual evaporation> 1980 mm/yr Class A pan Red Cliffs

<Volume disposed annually (ML/yr)> 152 ML/yr

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)> Currently 825 EC in RWC 11

<Sources of water to be disposed> Groundwater discharge and tile drainage

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> FMIT 4
<Synonyms> RWC 10 and RWC 11

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Commission and First Mildura Irrigation Trust (FMIT)

<**Project name**> FMIT 4 (RWC 10 and RWC 11)

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**>

Geological

<**Site description and Geomorphology**> The basin is the result of the combination of RWC 10 and RWC 11. It is located among the longitudinal Woorinen dunes and is bounded by gravel pits (for calcrete?) to southwest and semi-cleared mallee.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located northeast of the Wargan Fault and southeast of the Danyo Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (5 m) and is underlain by the Blanchetown Clay (10 m), the Parilla Sand (45 m), the Bookpurnong Beds, the Murray Group Limestone, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand, calcrete

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay and silty clay; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand.

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 10.5 kilometres

<**Head between basin and river/tributary**>

<Site Name> FMIT 4
<Synonyms> RWC 10 and RWC 11

<Direction of groundwater flow in regional aquifer> Southwest away from the River Murray (RWC, 1991).

<kv of artificial floor>

<kv and kh of host> Woorinen Formation: Kh = 40-50 m/day (Transmissivity 190 m^2/day (SR&WSC, 1974))

<kv and kh of aquitard>

<Thickness of aquitard> Blanchetown Clay: 10 metres; Upper Parilla Sand: 5-7 metres

<kv and kh of aquifer> Parilla Sand: Kh = 1.6 to 58 m/day (Duncan and Linke, 1992)

<EC of aquifer> >50,000 mg/L TDS (RWC, 1993)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 40 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The current salinity in the basin is 825 mg/L TDS, which suggest either the reading was taken just after disposal, or that the basin is receiving additional freshwater (perched aquifer). Flow in the perched aquifer is (similar to the Parilla Sand) radially outwards from beneath Mildura due to the seepage of irrigation excess. Basins RWC 1 and RWC C act as throughflow windows within the Woorinen Formation aquifer, allowing the groundwater to concentrate as it moves to the southwest. FMIT is northeast of these basins, and has the lowest salinity, perhaps indicating there is discharge from the perched aquifer. However, the evaporation potential of the basin is quite high (680 ML/yr) which would necessitate high flows through the basin which is of yet unproven. There is however, the possibility of leakage from the basin into the Parilla Sand due to the high level of the basin relative to the potentiometric surface of the Parilla. Leakage should not be substantial because of the thick layer of the Blanchetown Clay/Upper Parilla Sand aquitard (15 m).

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> FMIT 4
<Synonyms> RWC 10 and RWC 11

<Category - degree of hydraulic isolation>

<Evaporation surplus> 680 ML/yr evaporation potential (34 ha x 1980 mm/yr evaporation)

Interpretive 2

<Ranking of sustainability>

References Cited

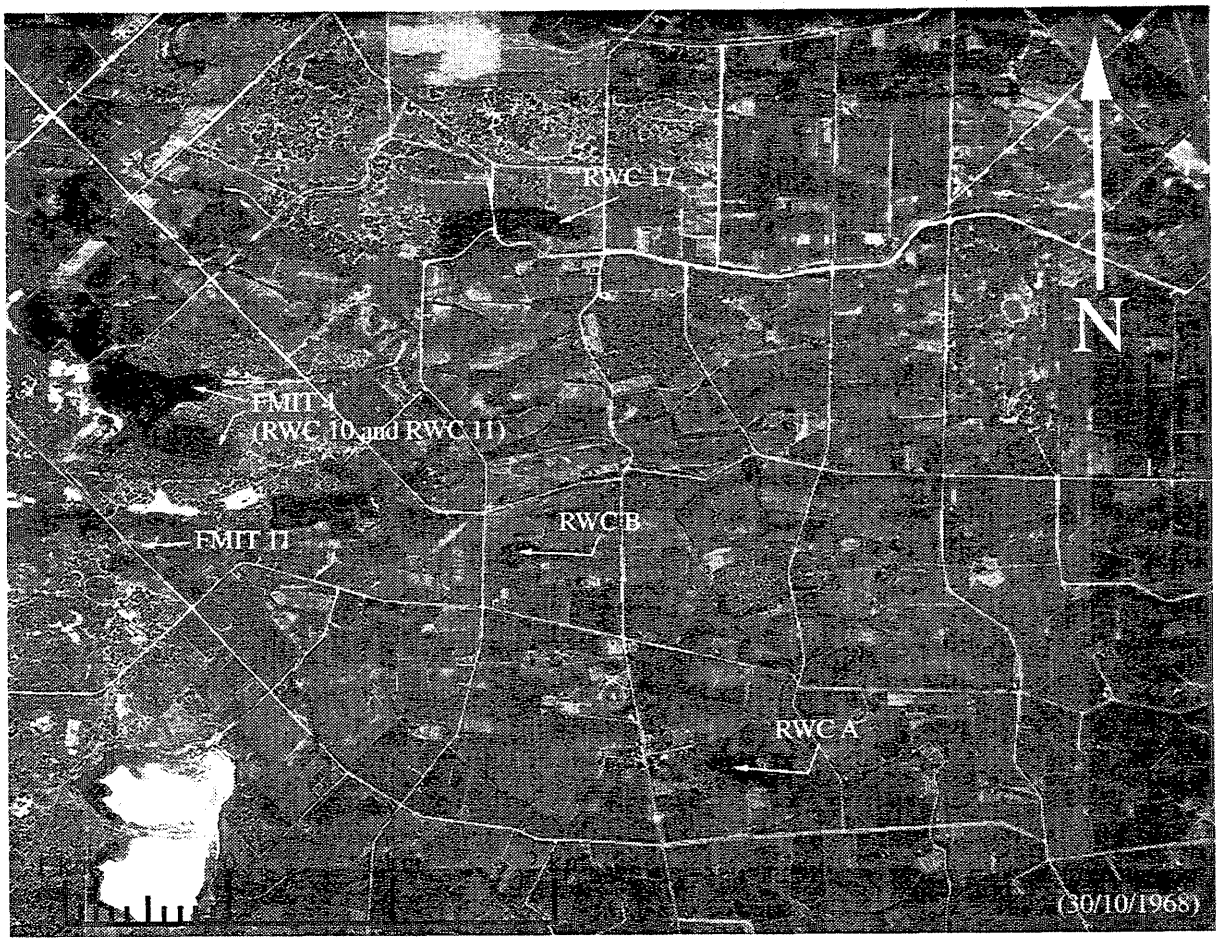
Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

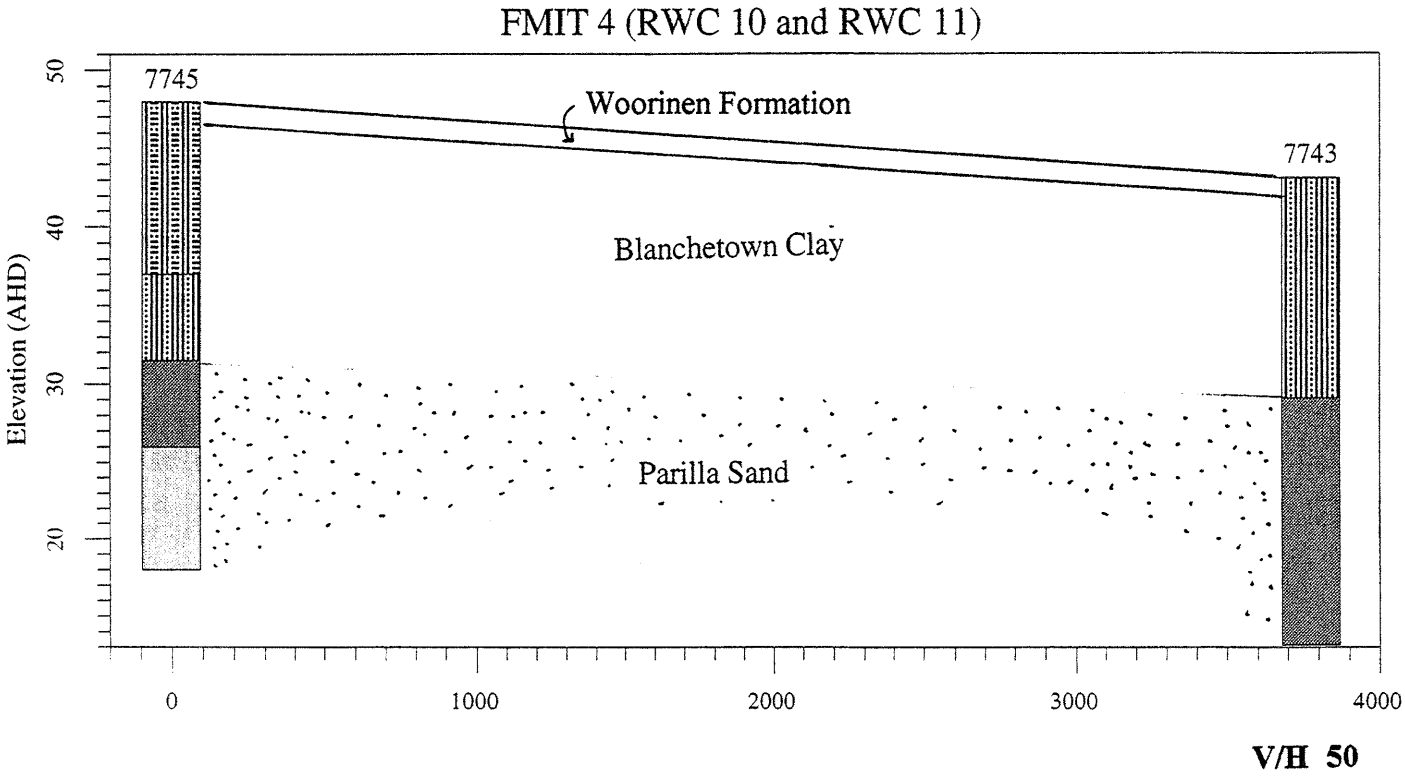
Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

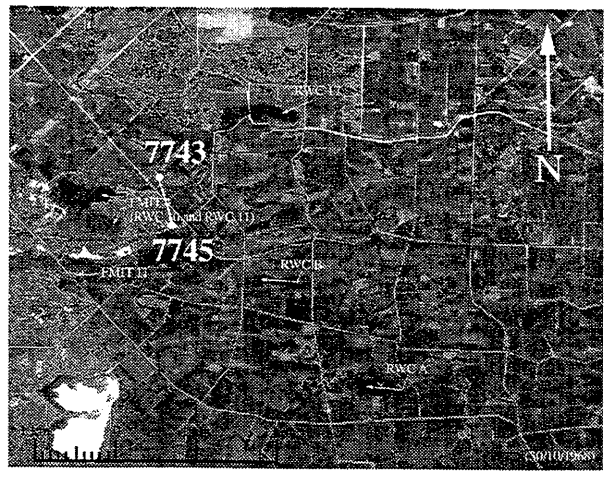
Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

State Rivers and Water Supply Commission, Victoria (SR&WSC), 1974- Sunraysia Salinity Investigations., Unpublished report

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


RWC 17
N
FMIT 4
(RWC 10 and RWC 11)
FMIT 17
RWC B
RWC A
(30/10/1968)


FMIT 4 (RWC 10 and RWC 11)
7745
Woorinen Formation
7743
Blanchetown Clay
Parilla Sand
Elevation (AHD)
50
40
30
20
0
1000
2000
3000
4000
V/H 50


7743
7745
N

<Site Name> FMIT 5
<Synonyms> Koorlong Tank

Spatial

<Location description> 13 kilometres SW of Mildura, Victoria and 13 kilometres WNW of Red Cliffs, Victoria

<Located in Murray Trench> No

<Location 1:250 000> Mildura

<Location 1:100 000> Mildura 7329

<Zone> 54

<Coordinates easting (AMG)> 597900

<Coordinates northing (AMG)> 6206100

<State> Victoria

General

<Year begun operation>

<Active/inactive> Active

<Full surface area (ha)> 87.3 ha

<Volume capacity (ML)> 1858.9 ML

<Full surface level (m AHD)> 37 m AHD

<Groundwater level (m AHD)> 38 m AHD; Parilla Sand: 37.5-38.8 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<Groundwater seepage/discharge> Discharge

<Average annual evaporation> Inflow/Evaporation = 0.85; 1980 mm Class A pan Red Cliffs

<Volume disposed annually (ML/yr)> 943 ML/yr

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)> 27,600 to 38,700 EC

<Sources of water to be disposed> Groundwater and Drainage

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> FMIT 5
<**Synonyms**> Koorlong Tank

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> First Mildura Irrigation Trust (FMIT)

<**Project name**> FMIT 5 Koorlong Tank

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**>

Geological

<**Site description and Geomorphology**> The basin is located in a deflation basin among the longitudinal Woorinen Formation dunes. The geometry of the western margin of the basin is controlled by the presence of Woorinen dunes, while the eastern margin is defined by salt flats and possibly a lunette.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located on the Wargan Fault, southeast of the Koorlong trough, and northwest of the Red Cliffs Ridge (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Blanchetown Clay (although there may be some Woorinen Formation on the margins) (18-22 m), and is underlain by the Parilla Sand (50 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990)

<**Host formation**> Blanchetown Clay

<**Host lithofacies**> Clay and silty clay

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay and silty clay; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**> Large basin with 3-4 necks and central islands

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 15 kilometres

<Site Name> FMIT 5
<Synonyms> Koorlong Tank

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Southwest away from the Murray River (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Blanchetown Clay: 18-22 metres; Upper Parilla Sand: 5-7 metres

<kv and kh of aquifer> Parilla Sand: 1 m/day (Linke, 1990b)

<EC of aquifer> Parilla Sand: >50 000 mg/L TDS (RWC, 1993)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 43-45 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Input into Koorlong Basins is at least 1926 ML/yr (evaporative capacity) and consists of a mixture of drainage disposal (943 ML/yr) and groundwater discharge. The groundwater discharge comes from either the Parilla Sand, the Woorinen Formation (perched aquifer), or a combination of the two. We know that nearby RWC 1 and RWC C receive water from the Woorinen Formation, but unlike them, the salinity of Koorlong Tank is quite high (27,600-38,700) suggesting either evaporative concentration or that the groundwater is from another source. The salinity of the Parilla Sand is over 50,000 EC, which could, when mixed with fresh disposal water give mid range salinities. A possible source from the Parilla Sand, is also supported because the basin has been the site of deflation and discharge in the past (which has eroded through the Woorinen Formation). Because Koorlong Tank is located above the Wargan Fault, the permeability of the Blanchetown Clay and Upper Parilla Sand may fracture enhanced allowing the groundwater in the Parilla (which is at artesian pressure) a route to the surface. However, the amount of Parilla discharge needed to maintain the water level in the basin with the high amount of evaporation would predict salinities in excess of what is found. The most likely scenario involves a mixing of the two waters: the Parilla Sand to increase the salinity and because of historical discharge; and the perched watertable because of the amount of low salinity water needed to maintain water levels, and because of the high potential of the Woorinen Formation due to irrigation input under the Mildura Area.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> FMIT 5
<Synonyms> Koorlong Tank

<Category - degree of hydraulic isolation>

<Evaporation surplus> Evaporation capacity 1926 ML/yr (1980 mm/yr x 87.3 ha)

Interpretive 2

<Ranking of sustainability>

References Cited

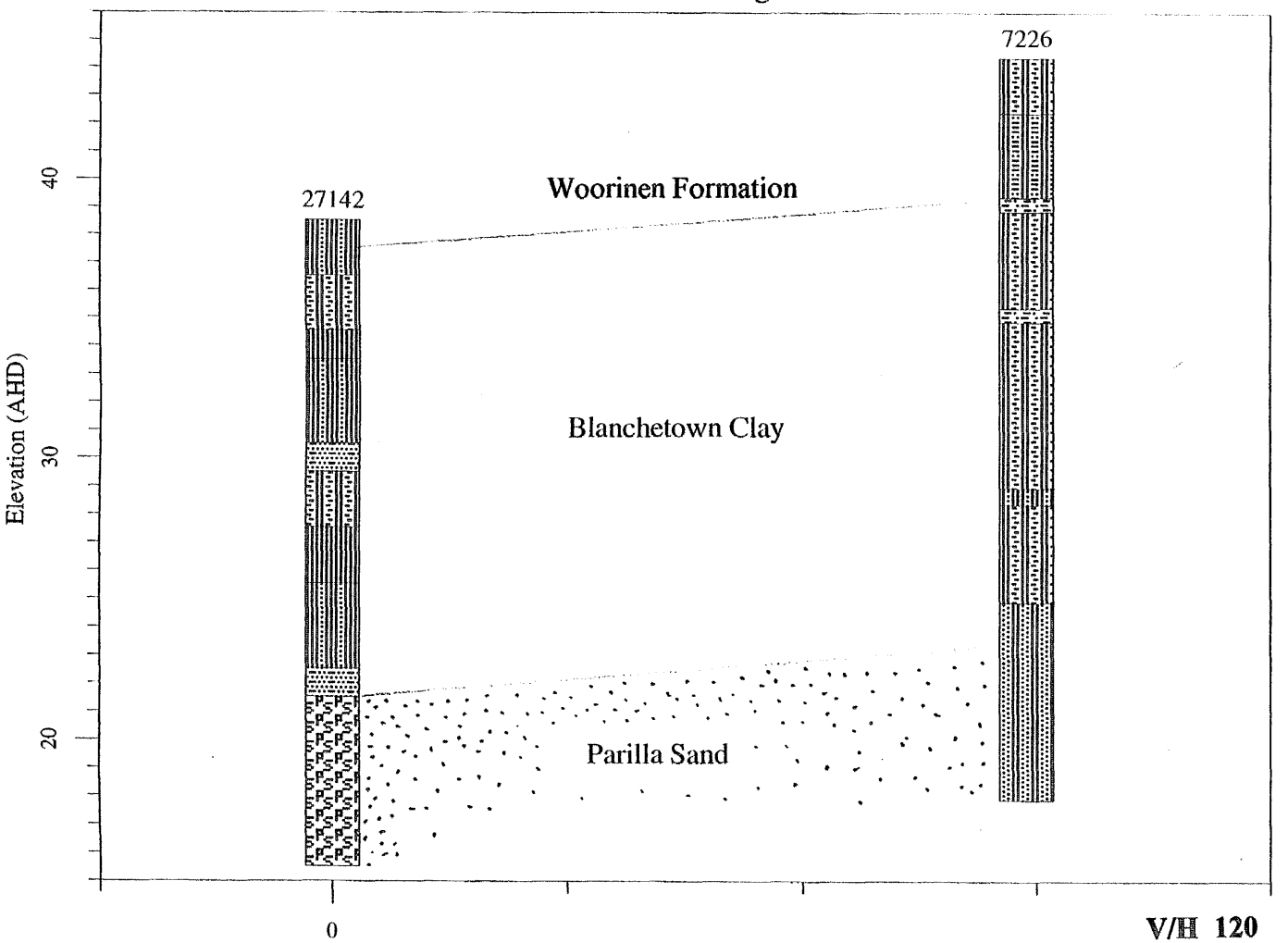
Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.

FMIT 5 - Koorlong Basin





<Site Name> FMIT 6
<**Synonyms**> Irymple Tank

Spatial

<**Location description**> 11 kilometres SW of Mildura, Victoria and 10 kilometres WNW of Red Cliffs, Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 598700

<**Coordinates northing (AMG)**> 6207300

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 10.8 ha

<**Volume capacity (ML)**> 192.4 ML

<**Full surface level (m AHD)**> 38.5 m AHD

<**Groundwater level (m AHD)**> 39 m AHD

<**Groundwater seepage/discharge**> Discharge

<**Average annual evaporation**> Inflow/Evaporation = 1.07; 1980 mm/yr Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**> 161 ML/yr

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**> currently 3260 mg/L TDS

<**Sources of water to be disposed**> Groundwater and Discharge

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> FMIT 6
<Synonyms> Irymple Tank

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> First Mildura Irrigation Trust (FMIT)

<**Project name**> FMIT 6 Irymple Tank

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is located in the northern part of a larger deflation basin that has eroded part of the way through the uneven surface of the Blanchetown Clay. It is bounded on the west by Woorinen Formation dunes and is surrounded by semi-cleared mallee and cropland.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located on the Wargan Fault, southeast of the Koorlong trough, and northwest of the Red Cliffs Ridge (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Blanchetown Clay (although there may be some Woorinen Formation on the margins) (17 m) and is underlain by the Parilla Sand (50 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Blanchetown clay

<**Host lithofacies**> Clay and silty clay

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay and silty clay; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 10 kilometres

<**Head between basin and river/tributary**>

<Site Name> FMIT 6
<Synonyms> Irymple Tank

<Direction of groundwater flow in regional aquifer> Southwest away from the Murray River (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Blanchetown Clay: 17 metres; Upper Parilla Sand: 5-7 metres

<kv and kh of aquifer> Parilla Sand: 1 m/day (Linke, 1990b)

<EC of aquifer> Parilla Sand: >50 000 mg/L TDS (RWC, 1993)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 43-45 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The current salinity of the basin is 3260 mg/L TDS, which means that either the measurement was either taken during active disposal, or that the long term salinity is about 3000 mg/L TDS. The former is probably true because the salinity of Koorlong Tank (connected to the basin immediately to the south) ranges from 27,600 to 38,700 EC, instead of the lower value. The basin receives both tile drainage (low salinity) and discharge from the groundwater which comes from either the Parilla Sand, the perched aquifer (in the Woorinen Formation), or a combination of the two. We know that nearby RWC 1 and RWC C receive water from the Woorinen Formation but unlike them, the salinity of Irymple Tank (assuming a long term salinity similar to Koorlong Tank) is quite high (27,600-38,700 EC) suggesting either evaporative concentration or that the groundwater is from another source. The salinity of the Parilla Sand is over 50,000 EC, which could, when mixed with fresh disposal water give mid range salinities.

A possible source from the Parilla Sand is also supported because the basin has been the site of deflation and discharge in the past (which has eroded through the Woorinen Formation). Because Irymple Tank is located above the Wargan Fault the permeability of the Blanchetown Clay and Upper Parilla Sand may be fracture enhanced allowing the groundwater in the Parilla (which is at artesian pressure) a route to the surface. However, the amount of Parilla discharge needed to maintain the water level in the basin with the high amount of evaporation would predict salinities in excess of what is found. The most likely scenario involves a mixing of the two waters: the Parilla Sand to increase the salinity and because of historical discharge; and the perched watertable because of the amount of low salinity water needed to maintain water levels and because of the high potential of the Woorinen Formation due to irrigation input under the Mildura Area. However, if the above assumption is incorrect and the long term salinity of the basin is low, the most likely source of groundwater discharge would be the Woorinen Formation (perched aquifer).

<Hydraulic linkage to surface runoff>

<Site Name> FMIT 6
<Synonyms> Irymple Tank

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus> Evaporation capacity 214 ML/yr (1980 mm/yr x 10.8 ha)

Interpretive 2

<Ranking of sustainability>

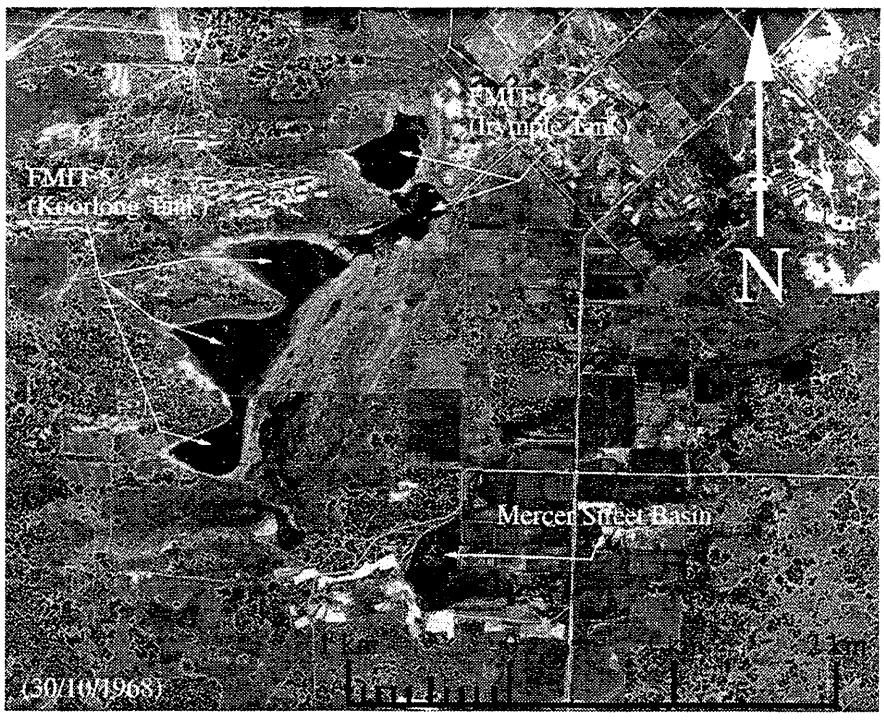
References Cited

Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


FMFT-6
(Unnamed Tank)
FMFT-5
(Koorlong Tank)
N
Mercer Street Basin
(30/10/1968)

<Site Name> FMIT 7a
<Synonyms> Gliderfield

Spatial

<Location description> 10 kilometres south of Merbein, Victoria and 11 kilometres SW of Mildura, Victoria

<Located in Murray Trench> No

<Location 1:250 000> Mildura

<Location 1:100 000> Mildura 7329

<Zone> 54

<Coordinates easting (AMG)> 596900

<Coordinates northing (AMG)> 6209600

<State> Victoria

General

<Year begun operation>

<Active/inactive> Active

<Full surface area (ha)> 10 ha

<Volume capacity (ML)> 66.8 ML

<Full surface level (m AHD)> 50.85 m AHD

<Groundwater level (m AHD)> 39 m AHD

<Groundwater seepage/discharge> Seepage

<Average annual evaporation> Inflow/evaporation = 1.2

<Volume disposed annually (ML/yr)> 465 ML/yr

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)> 5000-17,140 EC

<Sources of water to be disposed> Groundwater and Drainage

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> FMIT 7a
<Synonyms> Gliderfield

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> First Mildura irrigation Trust (FMIT)

<**Project name**> FMIT 7a Gliderfield

<**Natural, modified natural or constructed**> modified natural

<**Modification type and degree**> Banks have been built

Geological

<**Site description and Geomorphology**> The basin is built in a depression amongst the longitudinal Woorinen dunes and is connected to FMIT 7b by a channel at its western end . It is also surrounded by cropland and uncleared mallee and has a retaining wall built along the western margin of the basin.

<**Subsurface investigations at site**>

<<**Structural setting**> The basin is located on the Danyo Fault (on the downthrown side) and is northeast of the Wargan Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (2-3 m), and is underlain by the Blanchetown Clay (15 m), the Parilla Sand (50 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay and silty clay; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Irymple Member of Blanchetown Clay? and Parilla Sand

<**Aquifer lithofacies**> Irymple Member: Fine sand and silty sand; Parilla Sand: Fine to medium sand

<**Comments**> Connected to FMIT 7b

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 11 kilometres

<Site Name> FMIT 7a
<Synonyms> Gliderfield

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Southwest away from the Murray River (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Blanchetown Clay: 15 metres; Upper Parilla Sand: 5 metres

<kv and kh of aquifer> Parilla Sand: Kh = 1.6 to 58 m/day (Duncan and Linke, 1992)

<EC of aquifer> >50,000 mg/L TDS (RWC, 1993)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 45 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The salinity of the basin ranges from 5000-17,140 EC indicating that it receives input from relatively fresh water. We know it receives (combined with FMIT 7b) 465 ML/yr of water from drainage disposal, but inflow is 1.2 times the amount of evaporation (730 ML/yr), which means the basin needs to receive 365 ML/yr of extra inflow (RWC, 1993). The water probably comes from the perched aquifer in the Woorinen Formation which is driven by the irrigation mound under Mildura-Merbein. This is because of the position of the basin in a low lying area of the Woorinen Formation, the low salinity of water in the perched aquifer, and the large volume of water present in the Woorinen Formation.

The excess water in the basin may either pass through the basin back into the Woorinen Formation (throughflow) or seep into the Parilla Sand (because of the difference in the basin's full level and the potentiometric surface of the Parilla), possibly along the Danyo Fault. Regardless of where the water goes there should be few side effects because of the depth of the watertable, the groundwater flow is away from the Murray River, and the low salinity of the basin.

<Hydraulic linkage to surface runoff>

<Site Name> FMIT 7a
<Synonyms> Gliderfield

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus> Inflow is 1.2 times evaporation which is 732 ML/yr (37 ha x 1980 mm/yr evaporation), for Basins 7a and 7b. Therefore input should be 830 ML/yr of which tile drainage contributes 465 ML/yr.

Interpretive 2

<Ranking of sustainability>

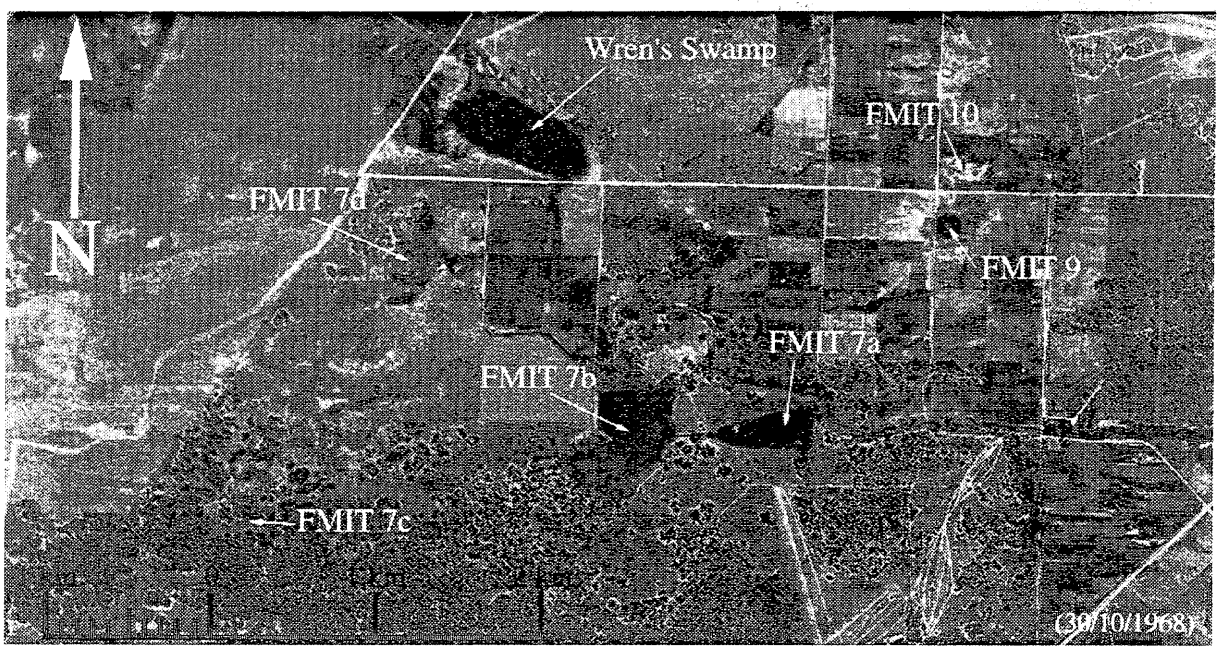
References Cited

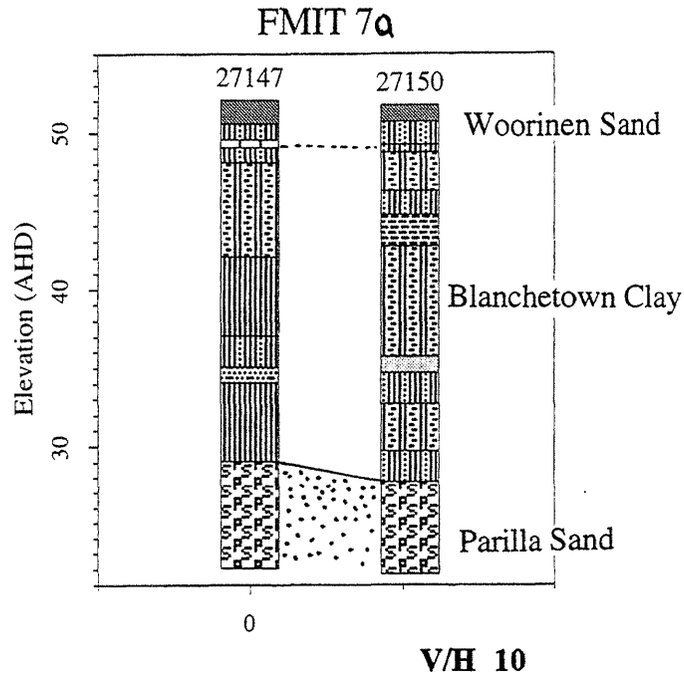
Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

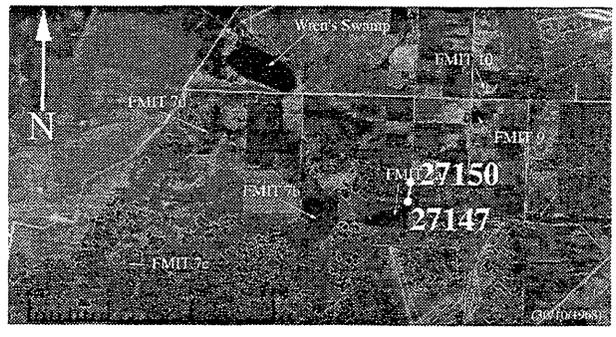
Hoxley, G., 1991- Hydrogeological summary of wetland areas in the Sunraysia Salinity Management Plan Area., Rural Water Corporation, Groundwater Section, Technical note 1

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.


Wren's Swamp
FMIT 10
FMIT 7d
N
FMIT 9
FMIT 7a
FMIT 7b
FMIT 7c
(30/10/1968)


FMIT 7a
27147
27150
Woorinen Sand
Blanchetown Clay
Parilla Sand
Elevation (AHD)
50
40
30
0
V/H 10


Wren's Swamp
FMIT 7b
FMIT 7a
FMIT 7c
27150
27147
N

<Site Name> FMIT 7b
<Synonyms> Gliderfield

Spatial

<Location description> Corner of Box Avenue and Twentieth Street in Merbein, Victoria

<Located in Murray Trench> No

<Location 1:250 000> Mildura

<Location 1:100 000> Mildura 7329

<Zone> 54

<Coordinates easting (AMG)> 596200

<Coordinates northing (AMG)> 6209700

<State> Victoria

General

<Year begun operation>

<Active/inactive> Active

<Full surface area (ha)> 27 ha

<Volume capacity (ML)> 236.2 ML

<Full surface level (m AHD)> 50.75 m AHD

<Groundwater level (m AHD)> 39 m AHD

<Groundwater seepage/discharge> Seepage

<Average annual evaporation> Inflow/evaporation = 1.2; 1980 mm/yr Class A pan Red Cliffs

<Volume disposed annually (ML/yr)> 465 ML/yr

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)> 5000-17140 EC

<Sources of water to be disposed> Groundwater and Discharge

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

Engineering/Admin

<Public or private operation> Public

<Site Name> FMIT 7b
<**Synonyms**> Gliderfield

<**Agency responsible**> First Mildura Irrigation Trust (FMIT)

<**Project name**> FMIT 7b Gliderfield

<**Natural, modified natural or constructed**> modified natural

<**Modification type and degree**> Banks have been built

Geological

<**Site description and Geomorphology**> The basin is built in a depression amongst the longitudinal Woorinen dunes and is connected to FMIT 7a by a channel at its eastern end. It is also surrounded by cropland and uncleared mallee, and has a retaining wall built along the western margin of the basin.

<**Subsurface investigations at site**>

<<**Structural setting**> The basin is located on the Danyo Fault (on the downthrown side) and is northeast of the Wargan Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (2-3 m), and is underlain by the Blanchetown Clay (15 m), the Parilla Sand (50 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay and silty clay; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Irymple Member of Blanchetown Clay? and Parilla Sand

<**Aquifer lithofacies**> Irymple Member: Fine sand and silty sand; Parilla Sand: Fine to medium sand

<**Comments**> Connected to FMIT 7a

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 11 kilometres

<**Head between basin and river/tributary**>

<**Direction of groundwater flow in regional aquifer**> Southwest away from the Murray River (RWC, 1991)

<Site Name> FMIT 7b
<Synonyms> Gliderfield

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Blanchetown Clay: 15 metres; Upper Parilla Sand: 5 metres

<kv and kh of aquifer> Parilla Sand: Kh = 1.6 to 58 m/day (Duncan and Linke, 1992)

<EC of aquifer> >50,000 mg/L TDS (RWC, 1993)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 45 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The salinity of the basin ranges from 5000-17,140 EC indicating that it receives input from relatively fresh water. We know it receives (combined with FMIT 7a) 465 ML/yr of water from drainage disposal, but inflow is 1.2 times the amount of evaporation (730 ML/yr), which means the basin needs to receive 365 ML/yr of extra inflow (RWC, 1993). This water probably comes from the perched aquifer in the Woorinen Formation which is driven by the irrigation mound under Mildura-Merbein. This is because of the position of the basin in a low lying area of the Woorinen Formation, the low salinity of water in the perched aquifer, and the large volume of water present in the Woorinen Formation.

The excess water in the basin may either pass through the basin back into the Woorinen Formation (throughflow), or seep into the Parilla Sand (because of the difference in the basin's full level and the potentiometric surface of the Parilla), possibly along the Danyo Fault. Regardless of where the water goes there should be few side effects because of the depth of the watertable, the groundwater flow is away from the Murray River, and the low salinity of the basin.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> FMIT 7b
<Synonyms> Gliderfield

<Category - degree of hydraulic isolation>

<Evaporation surplus> Inflow is 1.2 times evaporation which is 732 ML/yr (37 ha x 1980 mm/yr evaporation), for Basins 7a and 7b. Therefore input should be 830 ML/yr of which tile drainage contributes 465 ML/yr.

Interpretive 2

<Ranking of sustainability>

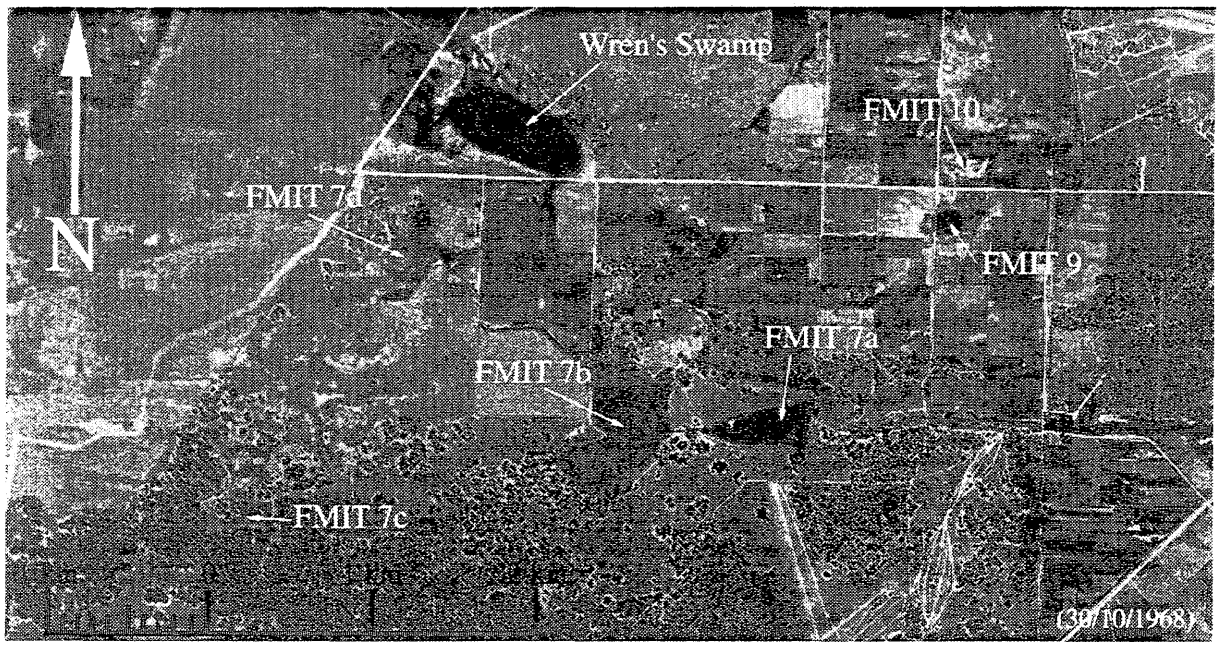
References Cited

Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins.. Rural Water Corporation, Unpublished report 1991/23

Hoxley, G., 1991- Hydrogeological summary of wetland areas in the Sunraysia Salinity Management Plan Area., Rural Water Corporation, Groundwater Section, Technical note 1

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.


Wren's Swamp
FMIT 10
FMIT 7d
N
FMIT 9
FMIT 7a
FMIT 7b
FMIT 7c
(30/10/1968)

<Site Name> FMIT 7c
<Synonyms>

Spatial

<**Location description**> 10 kilometres SSW of Merbein, Victoria and 13 kilometres SW of Mildura, Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 595000

<**Coordinates northing (AMG)**> 6209200

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 3.4 ha

<**Volume capacity (ML)**> 7.4 ML

<**Full surface level (m AHD)**> 47.9 m AHD

<**Groundwater level (m AHD)**> 39 m AHD

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> Inflow/evaporation = 1.2; 1980 mm/yr Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**> 11700-17410 EC

<**Sources of water to be disposed**> Groundwater discharge

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> FMIT 7c
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> First Mildura Irrigation Trust (FMIT)

<**Project name**> FMIT 7c

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Banks have been built

Geological

<**Site description and Geomorphology**> The basin is located in a depression among the longitudinal Woorinen dunes near the edge of the dunefield and is surrounded by cleared and uncleared mallee.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located on the Danyo Fault (on the upthrown side) and northeast of the Wargan Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (2-3 m), and is underlain by the Blanchetown Clay (15 m), the Parilla Sand (50 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay and silty clay; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Irymple Member of Blanchetown Clay? and Parilla Sand

<**Aquifer lithofacies**> Irymple Member: Fine sand and silty sand; Parilla Sand: Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 12 kilometres

<**Head between basin and river/tributary**>

<Site Name> FMIT 7c
<Synonyms>

<**Direction of groundwater flow in regional aquifer**> Southwest away from the Murray River (RWC, 1991)

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**>

<**Thickness of aquitard**> Blanchetown Clay: 15 metres; Upper Parilla Sand: 5 metres

<**kv and kh of aquifer**> Parilla Sand: Kh = 1.6 to 58 m/day (Duncan and Linke, 1992)

<**EC of aquifer**> >50,000 mg/L TDS (RWC, 1993)

<**Porosity of aquifer**>

<**Thickness of aquifer**> Parilla Sand: 45 metres; Irymple Member: 5 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> The basin has the potential to leak into the Parilla Sand because of the difference in the full level of the basin and the head in the Parilla. The amount of disposal in unknown, but input into the basin is 1.2 times the amount of evaporation (67 ML) which is equal to about 80 ML/yr of disposal (RWC, 1993). The salinity of the basin (11,700-17,410 EC) indicates that relatively freshwater is being disposed, which means it is likely to be either tile drainage (water from the perched aquifer) or direct discharge from the perched aquifer. Because of the high amount of accession of irrigation water (1.8 ML/ha/yr) into both the Parilla Sand and the perched aquifer (Woorinen Formation or Irymple Member of the Blanchetown Clay) there is a large component of lateral flow away from the mound. The amount of discharge into the basin would probably be small because it lies on the forward edge of the dunefield.

<**Hydraulic linkage to surface runoff**>

<**Category - hydraulic stability**>

<Site Name> FMIT 7c
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus> None, input is thought to be 1.2 times the amount of evaporation (3.4 ha x 1980 mm/yr)

Interpretive 2

<Ranking of sustainability>

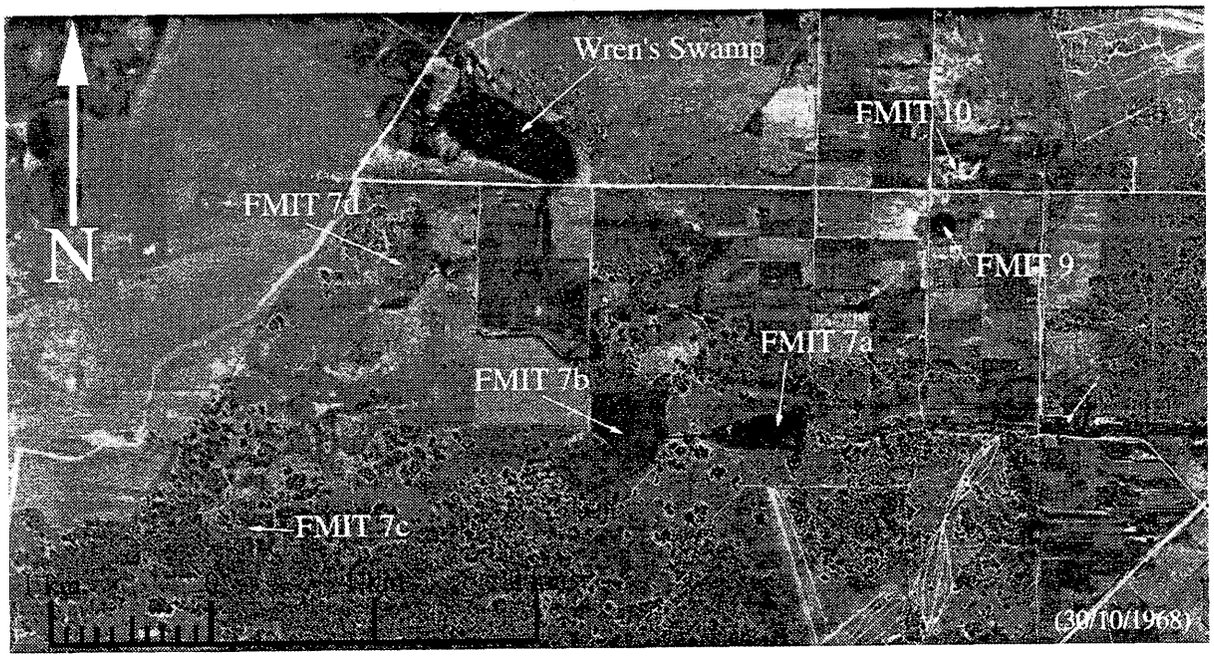
References Cited

Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

Hoxley, G., 1991- Hydrogeological summary of wetland areas in the Sunraysia Salinity Management Plan Area., Rural Water Corporation, Groundwater Section, Technical note 1

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.


Wren's Swamp
FMIT 10
FMIT 7d
N
FMIT 9
FMIT 7a
FMIT 7b
FMIT 7c
(30/10/1968)

<Site Name> FMIT 7d
<Synonyms>

Spatial

<**Location description**> 10 kilometres SSW of Merbein, Victoria and 13.5 kilometres west of Irymple, Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 594400

<**Coordinates northing (AMG)**> 6210000

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 2.3 ha

<**Volume capacity (ML)**> 2.7 ML

<**Full surface level (m AHD)**> 44.90 m AHD

<**Groundwater level (m AHD)**> 39 m AHD

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> 1980 mm/yr Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**> 11,700-79,300 EC

<**Sources of water to be disposed**> Groundwater discharge

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> FMIT 7d
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> First Mildura Irrigation Trust (FMIT)

<**Project name**> FMIT 7d

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is located in a depression among the longitudinal Woorinen dunes near the edge of the dunefield and is surrounded by cleared and uncleared mallee.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located on the Danyo Fault (on the upthrown side) and northeast of the Wargan Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (2-3 m), and is underlain by the Blanchetown Clay (15 m), the Parilla Sand (40 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay and silty clay; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Irymple Member of Blanchetown Clay? and Parilla Sand

<**Aquifer lithofacies**> Irymple Member: Fine sand and silty sand; Parilla Sand: Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 10 kilometres

<**Head between basin and river/tributary**>

<Site Name> FMIT 7d
<Synonyms>

<**Direction of groundwater flow in regional aquifer**> Southwest away from the Murray River (RWC, 1991).

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**>

<**Thickness of aquitard**> Blanchetown Clay: 15 metres; Upper Parilla Sand: 5 metres

<**kv and kh of aquifer**> Parilla Sand: Kh = 1.6 to 58 m/day (Duncan and Linke, 1992)

<**EC of aquifer**> 50,000 mg/L TDS (RWC, 1993)

<**Porosity of aquifer**>

<**Thickness of aquifer**> Parilla Sand: 45 metres; Irymple Member: 5 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> The basin has the potential to leak into the Parilla Sand because of the difference in the full level of the basin and the head in the Parilla. The amount of disposal is unknown, but it only has to be above 45 ML/yr (the evaporation capacity) to explain the salinities in the basin (11,700-79,300 EC). Because of the high amount of groundwater accession (1.8 ML/ha/yr), into both the Parilla Sand and perched aquifer there may be a component of discharge into the basin from the Woorinen Formation (or Irymple Member of the Blanchetown Clay). The amount of discharge would probably be small because the basin lies on the forward edge of the dunefield.

<**Hydraulic linkage to surface runoff**>

<**Category - hydraulic stability**>

<Site Name> FMIT 7d
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus> 45 ML/yr evaporation capacity (2.7 ha x 1980 mm/yr)

Interpretive 2

<Ranking of sustainability>

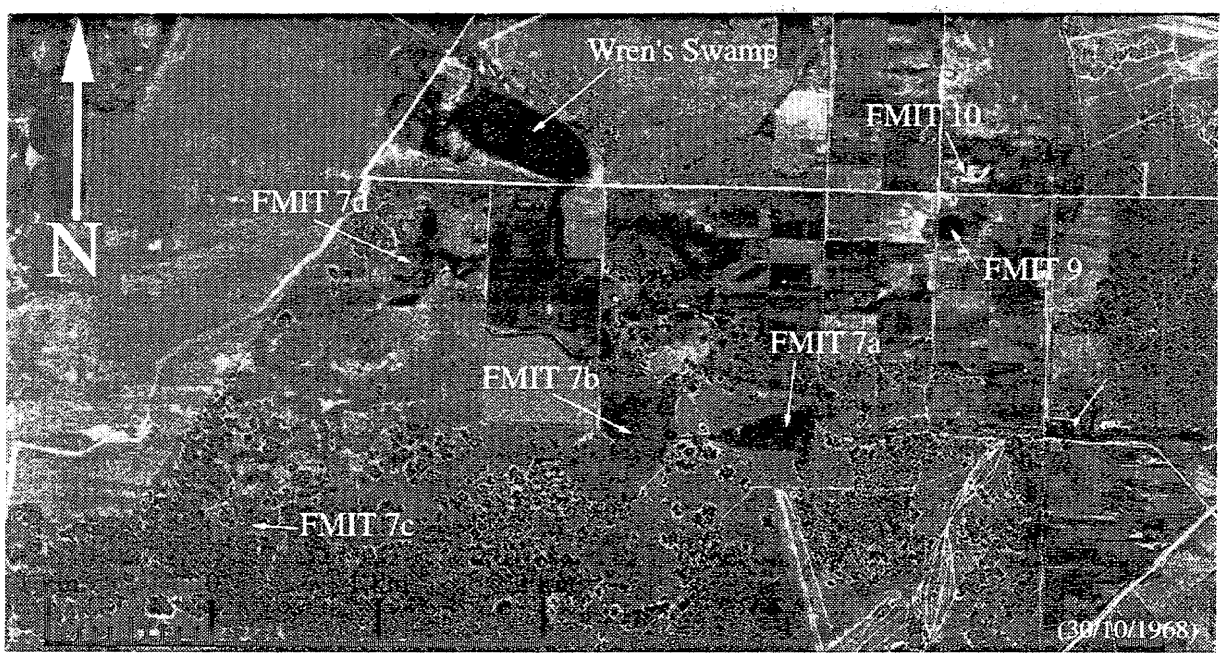
References Cited

Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

Hoxley, G., 1991- Hydrogeological summary of wetland areas in the Sunraysia Salinity Management Plan Area., Rural Water Corporation, Groundwater Section, Technical note 1

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.


N
Wren's Swamp
FMIT 10
FMIT 7d
FMIT 9
FMIT 7a
FMIT 7b
FMIT 7c
(30/10/1968)

<Site Name> FMIT 8
<Synonyms> Timmis Swamp

Spatial

<Location description> 8 kilometres SW of Mildura, Victoria and 11.5 kilometres NW of Red Cliffs, Victoria

<Located in Murray Trench> No

<Location 1:250 000> Mildura

<Location 1:100 000> Mildura 7329

<Zone> 54

<Coordinates easting (AMG)> 599800

<Coordinates northing (AMG)> 6210000

<State> Victoria

General

<Year begun operation>

<Active/inactive> Active

<Full surface area (ha)> 9.9 ha

<Volume capacity (ML)> 24.8 ML

<Full surface level (m AHD)> 44.75 m AHD

<Groundwater level (m AHD)> 40 m AHD

<Groundwater seepage/discharge> Seepage

<Average annual evaporation> Inflow/evaporation = 0.7

<Volume disposed annually (ML/yr)> 85 ML/yr

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)>

<Sources of water to be disposed> Groundwater and discharge

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> FMIT 8
<**Synonyms**> Timmis Swamp

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> First Mildura Irrigation Trust (FMIT)

<**Project name**> FMIT 8 Timmis Swamp

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is located in a deflation depression that appears to have eroded part way through the Blanchetown Clay. It is bounded on the south by the Woorinen Formation dunes and is surrounded by semi-cleared mallee and cropland.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located in the Koorlong Trough, southeast of the Danyo Fault, and northeast of the Wargan Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Blanchetown Clay (10 m), and underlain by the Parilla Sand (40 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Blanchetown Clay

<**Host lithofacies**> Clay and silty clay

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay and silty clay; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 8 kilometres

<**Head between basin and river/tributary**>

<Site Name> FMIT 8
<Synonyms> Timmis Swamp

<Direction of groundwater flow in regional aquifer> Southwest away from the Murray River (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Blanchetown Clay: 10 metres; Upper Parilla Sand: 5 metres

<kv and kh of aquifer> Parilla Sand: Kh = 1.6 to 58 m/day (Duncan and Linke, 1992)

<EC of aquifer> >50,000 mg/L TDS (RWC, 1993)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 35 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin has the potential to leak into the Parilla Sand, because the full level of the basin is higher than the potentiometric surface of the Parilla Sand. The salinity of the basin is unknown but it is unlikely that Timmis Swamp receives significant discharge from the perched aquifer because a broad area around the basin has deflated through the Woorinen Formation perched aquifer, and because the remaining pediments of perched aquifer are either isolated from the main body of flow (to the north), or is "downstream" of the flow in the aquifer (to the south).

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Site Name> FMIT 8
<Synonyms> Timmis Swamp

<Evaporation surplus> Evaporation capacity is 196 ML/yr (1980 mm/yr evaporation potential x 9.9 ha)

Interpretive 2

<Ranking of sustainability>

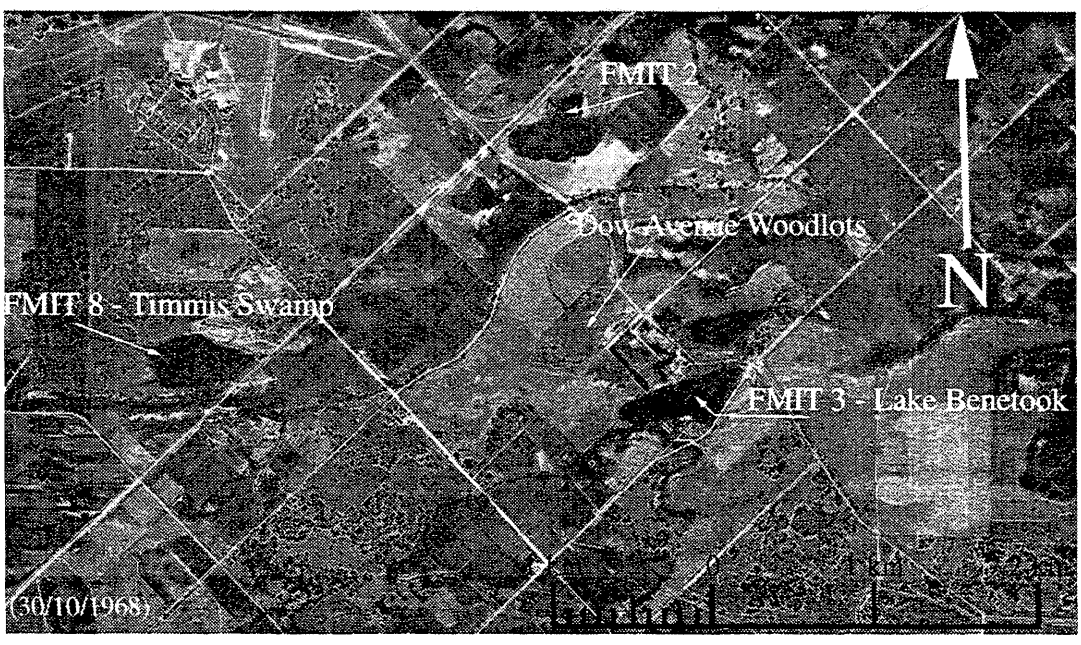
References Cited

Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

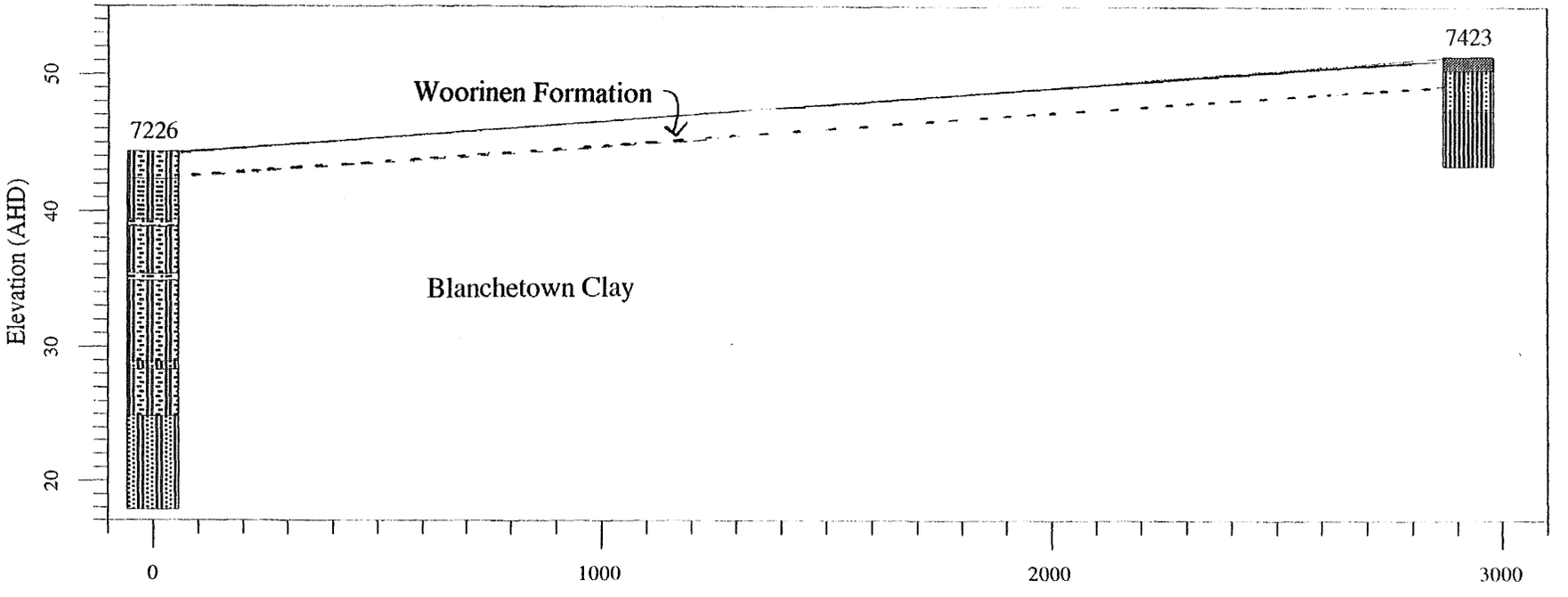
Hoxley, G., 1991- Hydrogeological summary of wetland areas in the Sunraysia Salinity Management Plan Area., Rural Water Corporation, Groundwater Section, Technical note 1

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

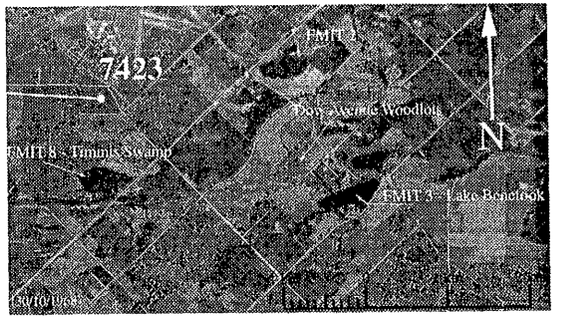
Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.


FMIT 2
Dow Avenue Woodlots
N
FMIT 8 - Timmis Swamp
FMIT 3 - Lake Benetook
(30/10/1968)

FMIT 8 - Timmis Swamp



V/H 30



<Site Name> FMIT 9
<Synonyms>

Spatial

<**Location description**> 8.5 kilometres south of Merbein and 9.6 kilometres SW of Mildura, Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 598000

<**Coordinates northing (AMG)**> 6210800

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 1.9 ha

<**Volume capacity (ML)**> 9.9 ML

<**Full surface level (m AHD)**> 39.50 m AHD

<**Groundwater level (m AHD)**> 40 m AHD

<**Groundwater seepage/discharge**> Discharge

<**Average annual evaporation**> 1980 mm/yr Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**> 3800 EC

<**Range of salinity in basin (EC)**> current 3800 mg/L TDS

<**Sources of water to be disposed**> Groundwater and discharge

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

Engineering/Admin

<**Public or private operation**> Public

<Site Name> FMIT 9
<Synonyms>

<Agency responsible> First Mildura Irrigation Trust (FMIT)

<Project name> FMIT 9

<Natural, modified natural or constructed> Natural

<Modification type and degree> None

Geological

<Site description and Geomorphology> The basin is located within a much larger deflation basin that has eroded through the uneven surface of the Blanchetown Clay. There appears to be some Woorinen dune activity within the deflation basin but it does not seem to effect basin placement.

<Subsurface investigations at site>

<Structural setting> The basin is located northeast of the Wargan Fault between the Danyo Fault and the Koorlong Trough (Thorne, Hoxley, and Chaplin, 1990).

<Stratigraphic setting> The basin is floored by the Yamba Formation (with Blanchetown Clay (12 m) around the basin margins) (1-2 m), and is underlain by the Parilla Sand (40 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley and Chaplin).

<Host formation> Yamba Formation

<Host lithofacies> Black clay and silt, also some salt

<Aquitard> Upper Parilla Sand

<Aquitard lithofacies> Pisolitic ferruginous duricrust and/or clayey sand

<Aquifer> Parilla Sand

<Aquifer lithofacies> Fine to medium sand

<Comments>

Summary of Hydrodynamics

<Distance to Murray or tributary> 7 kilometres

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Southwest away from the Murray River (RWC, 1991)

<Site Name> FMIT 9
<Synonyms>

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Upper Parilla Sand: 5-7 metres

<kv and kh of aquifer> Parilla Sand: Kh = 1.6-58 m/day (Duncan and Linke 1992)

<EC of aquifer> >50,000 mg/L TDS (RWC, 1993)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 35 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin has the potential to receive discharge from the Parilla Sand because of the high potential in the Parilla and the low level of the basin. The current salinity of the basin (3800 mg/L TDS) is the same as the disposal water suggesting either disposal occurred just before monitoring or that the long term average salinity is low (RWC, 1993). The former is probably true because the basin can not receive discharge from the perched aquifer (the only other source of low saline groundwater) because the area has deflated through the Woorinen Formation and the Blanchetown Clay. The amount of discharge from the Parilla Sand is unknown but it should be low because of the low head differential, the large area of possible discharge (over the entire deflation basin), and because of the Upper Parilla Sand aquitard.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Site Name> FMIT 9
<Synonyms>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

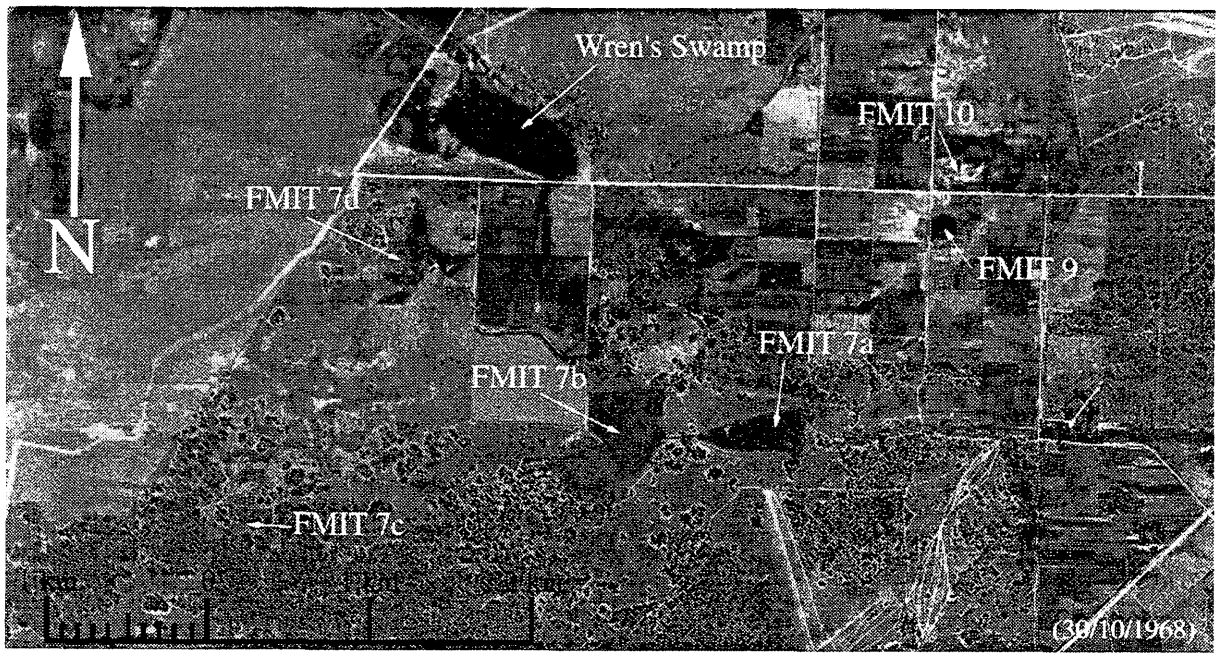
References Cited

Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

Hoxley, G., 1991- Hydrogeological summary of wetland areas in the Sunraysia Salinity Management Plan Area., Rural Water Corporation, Groundwater Section, Technical note 1

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.


N
Wren's Swamp
FMIT 10
FMIT 7d
FMIT 9
FMIT 7a
FMIT 7b
FMIT 7c
(30/10/1968)

<Site Name> FMIT 10
<Synonyms>

Spatial

<**Location description**> 8.5 kilometres south of Merbein and 9.6 kilometres SW of Mildura, Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 597900

<**Coordinates northing (AMG)**> 6210800

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 2.9 ha

<**Volume capacity (ML)**> 18.4 ML

<**Full surface level (m AHD)**> 38.6 m AHD

<**Groundwater level (m AHD)**> 40 m AHD

<**Groundwater seepage/discharge**> Discharge

<**Average annual evaporation**> 1980 mm/yr Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**> Dry

<**Sources of water to be disposed**> Groundwater and discharge

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

Engineering/Admin

<**Public or private operation**> Public

<Site Name> FMIT 10
<Synonyms>

<**Agency responsible**> First Mildura Irrigation Trust (FMIT)

<**Project name**> FMIT 10

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Banks have been built

Geological

<**Site description and Geomorphology**> The basin is located within a much larger deflation basin that has eroded through the uneven surface of the Blanchetown Clay. There appears to be some Woorinen dune activity within the deflation basin, but it does not seem to effect basin placement.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located northeast of the Wargan Fault between the Danyo Fault and the Koorlong Trough (Thorne, Hoxley, and Chaplin, 1990)

<**Stratigraphic setting**> The basin is floored by the Yamba Formation (with Blanchetown Clay (12 m) around the basin margins) (1-2 m), and is underlain by the Parilla Sand (40 m), the Bookpurnong Beds, the Murray Group Limestone, and the Renmark Group (Geology interpreted from Thorne, Hoxley and Chaplin).

<**Host formation**> Yamba Formation

<**Host lithofacies**> Black clay and silt, also some salt

<**Aquitard**> Upper Parilla Sand

<**Aquitard lithofacies**> Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 7 kilometres

<**Head between basin and river/tributary**>

<**Direction of groundwater flow in regional aquifer**> Southwest away from the Murray River (RWC, 1991)

R9500407

<Site Name> FMIT 10
<Synonyms>

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Upper Parilla Sand: 5-7 metres

<kv and kh of aquifer> Parilla Sand: Kh = 1.6-58 m/day (Duncan and Linke 1992)

<EC of aquifer> >50,000 mg/L TDS (RWC, 1993)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 35 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin has the potential to receive discharge from the Parilla Sand, because of the high potential in the Parilla and the low level of the basin. The basin should not receive discharge from the perched aquifer because it is within a much larger basin that has deflated through the Woorinen Formation and the Blanchetown Clay. The amount of discharge from the Parilla Sand is unknown but it should be low because of the low head differential, the large area of possible discharge (over the entire deflation basin), and because of the Upper Parilla Sand aquitard.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Site Name> FMIT 10
<Synonyms>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

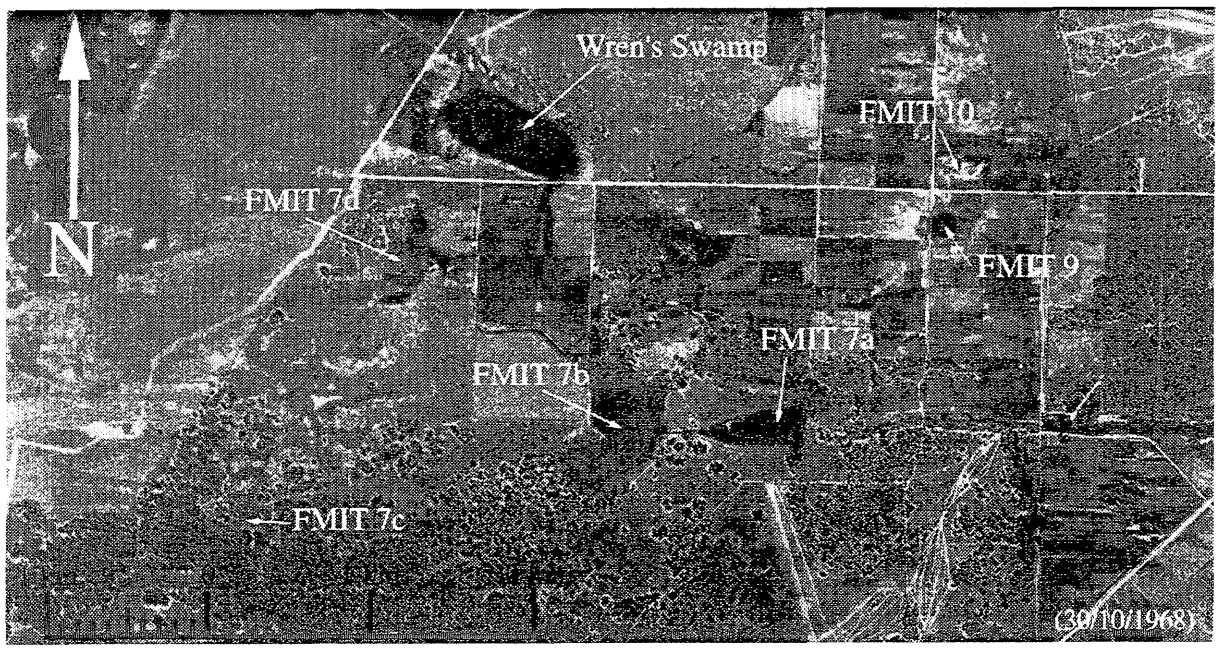
References Cited

Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

Hoxley, G., 1991- Hydrogeological summary of wetland areas in the Sunraysia Salinity Management Plan Area., Rural Water Corporation, Groundwater Section, Technical note 1

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.


N
Wren's Swamp
FMIT 10
FMIT 7d
FMIT 9
FMIT 7a
FMIT 7b
FMIT 7c
(30/10/1968)

<Site Name> FMIT 11
<Synonyms>

Spatial

<**Location description**> 6 kilometres NW of Red Cliffs, Victoria and 9 kilometres SSW of Mildura, Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 603300

<**Coordinates northing (AMG)**> 6206500

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Inactive

<**Full surface area (ha)**> 10 ha

<**Volume capacity (ML)**> 28 ML

<**Full surface level (m AHD)**> 47 m AHD

<**Groundwater level (m AHD)**> 39.5 m AHD

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> 1980 mm/yr Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**> None

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**> Dry

<**Sources of water to be disposed**> Groundwater discharge

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> FMIT 11
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> First Mildura Irrigation Trust (FMIT)

<**Project name**> FMIT 11

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is located in a depression among the longitudinal Woorinen dunes surrounded by cropland (east) and semi-cleared mallee (west).

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located northeast of the Wargan Fault and southeast of the Danyo Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (5 m), and underlain by the Blanchetown Clay (8 m), the Parilla Sand (35 m), the Bookpurnong Beds, the Murray Group, and the Renmark group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay and silty clay; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 12 kilometres

<**Head between basin and river/tributary**>

<Site Name> FMIT 11
<Synonyms>

<**Direction of groundwater flow in regional aquifer**> Southwest away from the River Murray (RWC, 1991)

<**kv of artificial floor**>

<**kv and kh of host**> Woorinen Formation: Kh = 40-50 m/day (Transmissivity 190 m^2/day (SR&WSC, 1974)

<**kv and kh of aquitard**>

<**Thickness of aquitard**> Blanchetown Clay: 8 metres; Upper Parilla Sand: 5-7 metres

<**kv and kh of aquifer**> Parilla Sand: Kh = 1.6 to 58 m/day (Duncan and Linke, 1992)

<**EC of aquifer**> >50,000 mg/L TDS (RWC, 1993)

<**Porosity of aquifer**>

<**Thickness of aquifer**> Parilla Sand: 30 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> The basin has the potential to leak into the Parilla Sand because the full level of the basin is higher (8 metres) than the potentiometric surface of the Parilla Sand and because of the erosional thinning of the Blanchetown Clay. The basin receives no disposal and is currently dry. However it may receive discharge from the perched aquifer in the Woorinen Formation. The perched aquifer is recharged by accession of irrigation water beneath Mildura and is under high pressure because of the volume being lost (1.8 ML/ha/yr) due to irrigation excess. If FMIT 11 does receives discharge, it would likely be as a throughflow basin offering a window into the radial flow of the Woorinen Formation. The amount of discharge (if it occurs) is less than 198 ML/yr (evaporation capacity), and may be seasonal.

<**Hydraulic linkage to surface runoff**>

<**Category - hydraulic stability**>

<**Category - degree of hydraulic isolation**>

<Site Name> FMIT 11
<Synonyms>

<**Evaporation surplus**> 198 ML/yr evaporation potential (10 ha x 1980 mm/yr evaporation)

Interpretive 2

<**Ranking of sustainability**>

References Cited

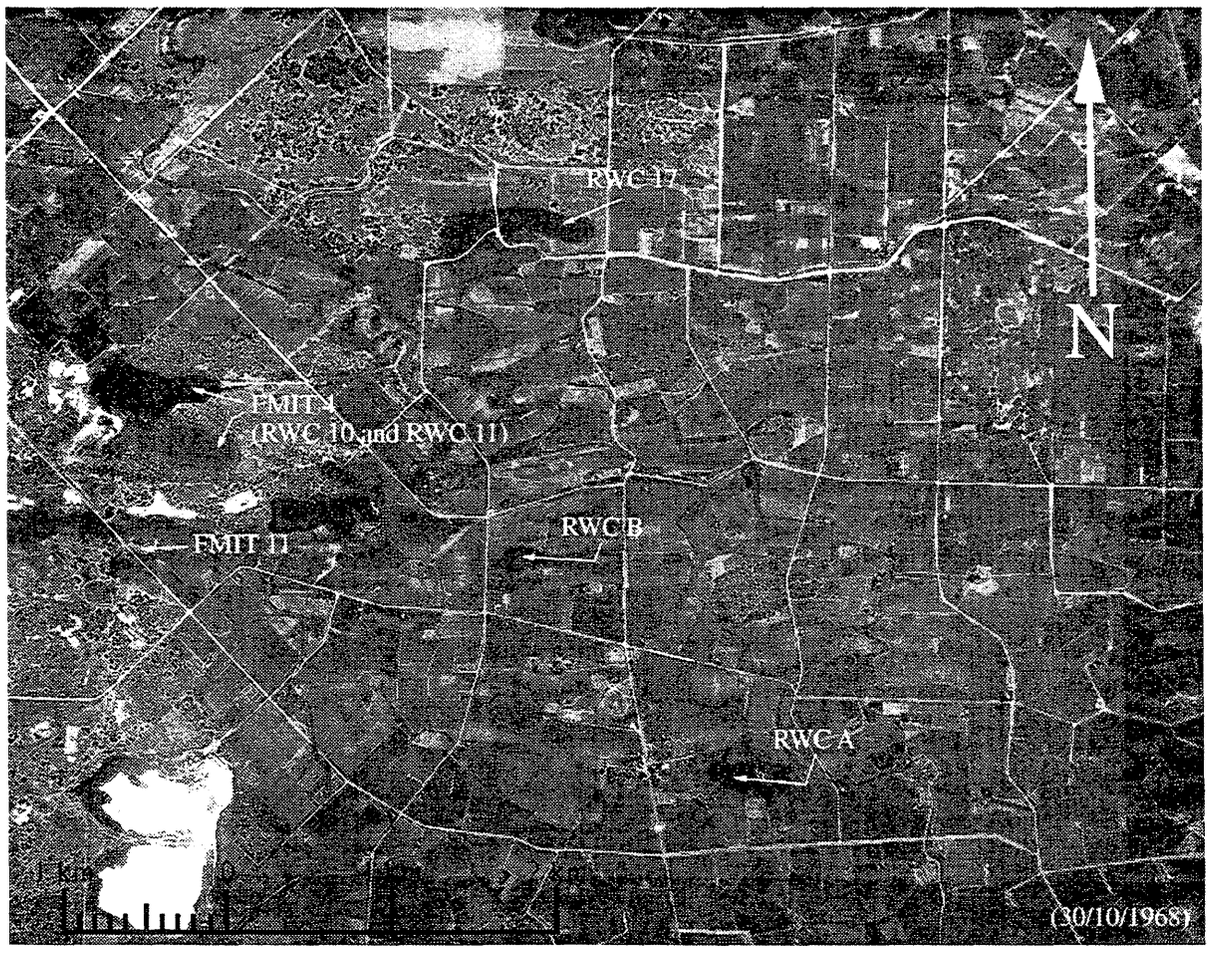
Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

State Rivers and Water Supply Commission, Victoria (SR&WSC), 1974- Sunraysia Salinity Investigations., Unpublished report

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


RWC 17
N
FMIT 1
(RWC 10 and RWC 11)
RWC B
FMIT 11
RWC A
1 km
0
(30/10/1968)

<Site Name> Forbes 66
<Synonyms> Ian Forbes Basin 66

Spatial

<Location description> 8 kilometres SE of Red Cliffs, Victoria and 4 kilometres SSW of Karadoc, Victoria

<Located in Murray Trench>Yes

<Location 1:250 000> Mildura

<Location 1:100 000> Mildura 7329

<Zone> 54

<Coordinates easting (AMG)> 616000

<Coordinates northing (AMG)> 6197800

<State> Victoria

General

<Year begun operation>

<Active/inactive> Active

<Full surface area (ha)> 12.5 ha

<Volume capacity (ML)>

<Full surface level (m AHD)> 39.6 m AHD

<Groundwater level (m AHD)> 39 m AHD (RWC, 1993); Channel Sand: 36.5-37.0 m AHD; Parilla Sand: 36.3 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<Groundwater seepage/discharge> Seepage

<Average annual evaporation> Inflow/evaporation = 1.2; 1980 mm/yr Class A pan Red Cliffs

<Volume disposed annually (ML/yr)> 162 ML/yr

<Salinity of water disposed (EC)> 2000 EC

<Range of salinity in basin (EC)>

<Sources of water to be disposed> Tile Drains of 112 ha at 1.4 ML/ha

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> Forbes 66
<Synonyms> Ian Forbes Basin 66

Engineering/Admin

<**Public or private operation**> Private

<**Agency responsible**>Landholder

<**Project name**> Forbes 66

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is located on the edge of the Murray Trench on top of the Rufus Formation. It was built in a depression among the longitudinal Woorinen dunes and is surrounded by cleared mallee.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located in the Karadoc Trough and northeast of the Wargan Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (5 m), and underlain by the Rufus Formation (3-5 m), the Channel Sand (6-10 m), the Blanchetown Clay (10-12 m), the Parilla Sand (65 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group. (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Rufus Formation and Blanchetown Clay

<**Aquitard lithofacies**> Rufus Formation: silt and silty clay: Blanchetown Clay: Clay and clayey silt

<**Aquifer**> Channel Sand and Parilla Sand

<**Aquifer lithofacies**> Channel Sand and Parilla Sand: Fine to medium grained sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 4 kilometres

<Site Name> Forbes 66
<Synonyms> Ian Forbes Basin 66

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Northeast towards the river, although there may be component of flow west towards the edge of the trench (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Rufus Formation: 3-5 metres; Blanchetown Clay: 10-12 metres

<kv and kh of aquifer> Channel Sand: Kh = 10-40 m/day; Parilla Sand: Kh = 1 m/day (Linke, 1990b)

<EC of aquifer> > 50,000 mg/L TDS (RWC, 1993); Channel Sand: 40,000 EC; Parilla Sand: 40,000 EC (Thorne, Hoxley, and Chaplin, 1990)

<Porosity of aquifer> Channel Sand: 20% (Linke, 1990b)

<Thickness of aquifer> Channel Sand: 6-10 metres; Parilla Sand: 65 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin has the potential to leak into the Channel Sand because its full level is higher than the potentiometric level of the Channel Sand. The Channel Sand is protected by the Rufus Formation, which acts an aquitard and is assumed to leak at 2 mm/day (Linke, 1994a). The amount of water in the basin is controlled by the evaporation capacity which is estimated to be 237 ML/yr (1980 mm/yr x 12.5 ha) which is higher than the annual amount of tile drainage the basin receives. The basin also receives and contributes to the perched aquifer within the Woorinen Formation causing a rise 0.5 metres in the height of the watertable around the basin. The perched aquifer will grow until it reaches an equilibrium between input and seepage/evaporation causing potential problems to low lying areas in the vicinity. The groundwater that enters the Channel Sand may move towards and enter the river causing potential point source salt accumulation.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> Forbes 66
<Synonyms> Ian Forbes Basin 66

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

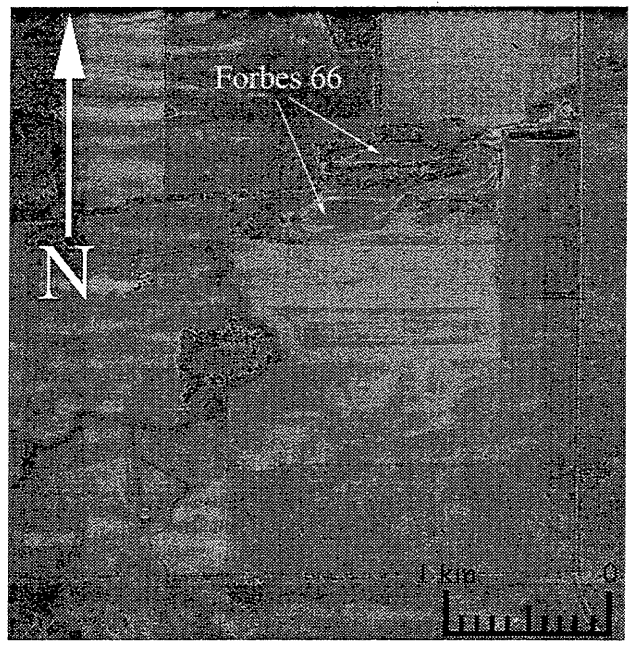
Linke, G., 1994a- Nangiloc-Colignan SMP - Ian Forbes Basin - Evaporation capacity - CMS Comps., Unpublished working file No. 02/00875

Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


Forbes 66
N
1 km
0

<Site Name> Forbes 67
<Synonyms> Ian Forbes Basin 67

Spatial

<Location description> 1.5 kilometres SW of Karadoc Swamp and 8 kilometres NE of Carwarp, Victoria

<Located in Murray Trench> Yes

<Location 1:250 000> Mildura

<Location 1:100 000> Mildura 7329

<Zone> 54

<Coordinates easting (AMG)> 616700

<Coordinates northing (AMG)> 6192000

<State> Victoria

General

<Year begun operation>

<Active/inactive> Active

<Full surface area (ha)>

<Volume capacity (ML)>

<Full surface level (m AHD)>

<Groundwater level (m AHD)> Channel Sand: 37.0-37.3 m AHD; Parilla Sand: 37.0 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<Groundwater seepage/discharge>

<Average annual evaporation> 1980 mm/yr Class A pan Red Cliffs

<Volume disposed annually (ML/yr)> 135 ML/yr

<Salinity of water disposed (EC)> 2000 EC

<Range of salinity in basin (EC)>

<Sources of water to be disposed> Tile Drainage

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> Forbes 67
<Synonyms> Ian Forbes Basin 67

Engineering/Admin

<Public or private operation> Private

<Agency responsible> Landholder

<Project name> Forbes 67

<Natural, modified natural or constructed> Natural

<Modification type and degree> None

Geological

<Site description and Geomorphology> The basin is located in the Murray Trench on the Coonambidgal Formation between Yatpool Basin and Karadoc Swamp. There is evidence of salinisation in the low lying areas around the basin and of salt accumulation within the basin (Yamba Formation?).

<Subsurface investigations at site>

<Structural setting> The basin is northwest of the Neckarboo Ridge, northeast of the Wargan Fault, and southeast of the Karadoc Trough (Thorne, Hoxley, and Chaplin, 1990).

<Stratigraphic setting> The basin is floored by the Coonambidgal Formation (Yamba Formation too?) (2-5 m), and underlain by the Channel Sand (6-10 m), the Parilla Sand (80 m), the Bookpurnong beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<Host formation> Coonambidgal Formation

<Host lithofacies> Silt and silty clay

<Aquitard> Coonambidgal Formation and Upper Parilla Sand

<Aquitard lithofacies> Coonambidgal Formation: Silt and silty clay; Upper Parilla Sand: Clayey sand and/or pisolitic ferruginous duricrust

<Aquifer> Channel Sand and Parilla Sand

<Aquifer lithofacies> Channel Sand and Parilla Sand: Fine to medium quartz sand

<Comments>

Summary of Hydrodynamics

<Distance to Murray or tributary> 3.5 kilometres to Inlet Creek

<Site Name> Forbes 67
<Synonyms> Ian Forbes Basin 67

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Northwest towards Yatpool Basin (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Coonambidgal Formation: 3 metres; Upper Parilla Sand: 3-5 metres

<kv and kh of aquifer> Channel Sand: 10-40 m/day, Parilla Sand: 1 m/day (Linke, 1990b)

<EC of aquifer> > 50,000 mg/L TDS (RWC, 1993); Channel Sand: 50,000-60,000 EC; Parilla Sand: 40,000 EC (Thorne, Hoxley, and Chaplin, 1990)

<Porosity of aquifer> Channel Sand: 20% (Linke, 1990b)

<Thickness of aquifer> Channel Sand: 6-10 metres; Parilla Sand: 80 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> It is difficult to determine the leakage potential of Forbes 67 because nothing is known about its size or full level. From airphoto interpretation, it appears to have received some groundwater discharge in the past because of the amount of salt in the basin. If the basin leaked though the Coonambidgal Formation into the Channel Sand, the water would be intercepted by Yatpool Basin, a regional discharge zone. There is also the potential for leakage into the Parilla Sand because the Channel Sand and Parilla Sand are at the same pressure which could indicate some degree of connection.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> Forbes 67
<Synonyms> Ian Forbes Basin 67

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

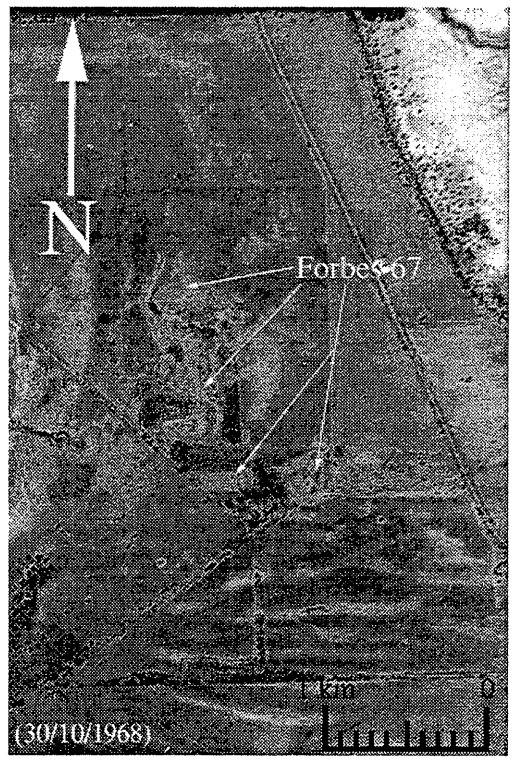
<Ranking of sustainability>

References Cited

Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
Forbes-67
1.5m
0
(30/10/1968)

<Site Name> Frankel/MPI
<Synonyms>

Spatial

<Location description>

<Located in Murray Trench> Yes

<Location 1:250 000>

<Location 1:100 000>

<Zone>

<Coordinates easting (AMG)>

<Coordinates northing (AMG)>

<State> Victoria

General

<Year begun operation>

<Active/inactive>

<Full surface area (ha)> 80 ha

<Volume capacity (ML)>

<Full surface level (m AHD)>

<Groundwater level (m AHD)>

<Groundwater seepage/discharge>

<Average annual evaporation>

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)>

<Sources of water to be disposed> Irrigation discharge

<Terminal/throughflow basin>

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> Frankel/MPI
<Synonyms>

Engineering/Admin

<Public or private operation> Public

<Agency responsible>

<Project name> Frankel/MPI

<Natural, modified natural or constructed>

<Modification type and degree>

Geological

<Site description and Geomorphology>

<Subsurface investigations at site>

<Structural setting>

<Stratigraphic setting>

<Host formation>

<Host lithofacies>

<Aquitard>

<Aquitard lithofacies>

<Aquifer>

<Aquifer lithofacies>

<Comments>

Summary of Hydrodynamics

<Distance to Murray or tributary>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer>

<kv of artificial floor>

<Site Name> Frankel/MPI
<Synonyms>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard>

<kv and kh of aquifer>

<EC of aquifer> > 50,000 mg/L TDS (RWC, 1993a)

<Porosity of aquifer>

<Thickness of aquifer>

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer>

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

<Site Name> Girgarre No 1 (Bays A, B, C)
<Synonyms>

Spatial

<Location description>

<Located in Murray Trench> Yes

<Location 1:250 000> Bendigo

<Location 1:100 000> Echuca 7825

<Zone> 55

<Coordinates easting (AMG)> 315200

<Coordinates northing (AMG)> 5967300

<State> Victoria

General

<Year begun operation> 1987

<Active/inactive> Active

<Full surface area (ha)> Total: 28 ha (A:13 ha, B:13 ha, C:4 ha)

<Volume capacity (ML)> Total: 86 ML (A:30 ML, B:38 ML, C:18 ML)

<Full surface level (m AHD)> 103.70 m AHD

<Groundwater level (m AHD)> 102.70 m AHD

<Groundwater seepage/discharge> Seepage

<Average annual evaporation> Inflow/evaporation = 1.2

<Volume disposed annually (ML/yr)> 411 ML

<Salinity of water disposed (EC)> 17,000 EC

<Range of salinity in basin (EC)> A: 1360-22,300 EC, B: 1510-61,100 EC, C: 6500-80,000 EC

<Sources of water to be disposed> Groundwater pumps

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> Natural clay

<Review of environmental impacts>

Engineering/Admin

<Public or private operation> Public

<Site Name> Girgarre No 1 (Bays A, B, C)
<Synonyms>

<Agency responsible> Rural Water Corporation

<Project name> Girgarre No 1

<Natural, modified natural or constructed> Fully constructed, pumped saline groundwater evaporation basins

<Modification type and degree>

Geological

<Site description and Geomorphology> The evaporation basin project area lies within the southern edge of the Murray Basin Riverine Plain. The area is topographically a flat plain with very little relief. Approximately five kilometres to the south are low bedrock hills (edge of the Tertiary sediments) and to the west are the natural Corop lakes and their lunettes.

Across the project area, ancestral flow paths of the Goulburn River are the main geomorphological features. The results of this are meandering depressions of up to four metres depth below the general plain within a definable flood plain up to two kilometres wide (Ife, 1984).

<Subsurface investigations at site> The project area has been extensively drilled. 57 observation bores have been drilled within the confines of the basin reserve, and a further 80 or so bores occur within 3 kilometres of the basin. The drilling program was targeted at depths less than 30 metres, with constructed bores installed at all levels within this depth. One 95 m. and 45 m. bore was also drilled at the site. Several deeper bores to bedrock depth occur within 20 kilometres of the project area (RWC, Tatura).

<Structural setting> The site occurs entirely on an area of Quaternary and late Tertiary age alluvial sedimentary material that shows a very stable structural setting.

<Stratigraphic setting> The basin is floored by the Shepparton Formation (70-100 m), and underlain by Siluro-Devonian Basement (Ife, 1984)

<Host formation> Shepparton Formation

<Host lithofacies> Consists predominantly of clayey sediments containing interspersed, elongated, lensing silt and sand deposits of alluvial origin. At the project area, drilling has identified three phases of sand deposition within the top 30 metres of the sequence. These three aquifers occur in approximately each third of the top 30 metres of the formation. They are characterised by differing water salinities, generally increasing with depth (RWC, Tatura).

<Aquitard> Shepparton Formation

<Aquitard lithofacies> The clayey parts of the upper Shepparton formation could be considered as an aquitard of low but variable hydraulic conductivity. The clayey materials of this formation are far floodplain deposits of both the ancestral rivers and older prior stream systems that traversed the area during the Quaternary. Dust deposition may also have contributed a small portion of the sequence (RWC, Tatura).

<Aquifer> Shepparton Formation

<Aquifer lithofacies> The three aquifer systems identified by the site drilling are channel and point bar deposits of the ancestral rivers and older prior streams (deeper than 10 m. approx). Pumping tests carried out on the different depth aquifers indicate transmissivities of up to approximately 500 m^2/day and a high degree of hydraulic connection between the aquifers. A feature of this type of aquifer is the high degree of inhomogeneity of the system that is a result of the discontinuous and variable nature of the sand bodies within the enclosing clayey and silty materials (RWC, Tatura).

<Site Name> Girgarre No 1 (Bays A, B, C)
<Synonyms>

<Comments>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> The Evaporation Basin site lies adjacent to the Deakin Main Drain which flows north to the Murray River near Echuca, a distance of approximately 30 kilometres in a straight line, but obviously much greater in drain distance.

<**Head between basin and river/tributary**> The nominal basin operation elevation is 103.70 m AHD and the elevation of the Deakin Main Drain adjacent to the basin is 101.24 m AHD. (at T101 groundwater discharge point.)

<**Direction of groundwater flow in regional aquifer**> Groundwater flow direction is to the north west and has a gradient of approximately 1:2800, or approximately parallel to the land surface.

<**kv of artificial floor**> Kv = 8.6×10^{-3} m/day

<**kv and kh of host**> Shepparton Formation: variable Kv = 6×10^{-5} to 1.2×10^{-1} m/day; Kh = 0.2 to 0.7 m/day

<**kv and kh of aquitard**> Shepparton Formation: variable Kv = 6×10^{-5} to 1.2×10^{-1} m/day; Kh = 0.2 to 0.7 m/day

<**Thickness of aquitard**> Shepparton Formation: 70 metres

<**kv and kh of aquifer**> Kv and Kh: 0.12 to 2.5 m/day. At a depth of 190-200 m T=235 m^2/day (T102 IFE, 1988)

<**EC of aquifer**> Salinities extremely variable, generally increase with depth in top 30 metres of profile. For shallow aquifers (<12 m deep), 2 - 8000 EC; intermediate aquifers (12-20 m depth), 4 -30,000 EC; deeper aquifers (>20 m deep), > 15,000 EC.

<**Porosity of aquifer**>

<**Thickness of aquifer**> Variable depending on presence or absence of sand bodies

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**> Study carried our in 1956 indicated the presence of a water table within 2 metres of surface under at least 70% of the project area in 1982. (Dept. Ag.)

Interpretive 1

<**Hydraulic linkage to regional aquifer**> Due to groundwater pumping from the three pumps that surround the basin, hydraulic connection to the 'Regional' aquifer is unlikely. Any seepage from the basin is considered to be part of the 'closed loop' water flow that is intercepted within the area of drawdown of the groundwater pumps (RWC, Tatura).

<Site Name> Girgarre No 1 (Bays A, B, C)
<Synonyms>

<**Hydraulic linkage to surface runoff**> The basin is surrounded by an interception drain and a pump returns any collected water back to the basin. 30 monitoring bores around the basin are used to determine rises in the watertable and/or deterioration to water quality as a consequence of basin seepage (RWC, Tatura).

<**Category - hydraulic stability**> Due to the basin being within the area of influence of three groundwater pumps, the hydraulic stability should be considered good.
Since the commencement of operation of the pumps and the basin, groundwater levels in the project area have declined relative to those outside the project area (RWC, Tatura).

<**Category - degree of hydraulic isolation**> As above

<**Evaporation surplus**> Within the range 250 to 600 mm/yr

Interpretive 2

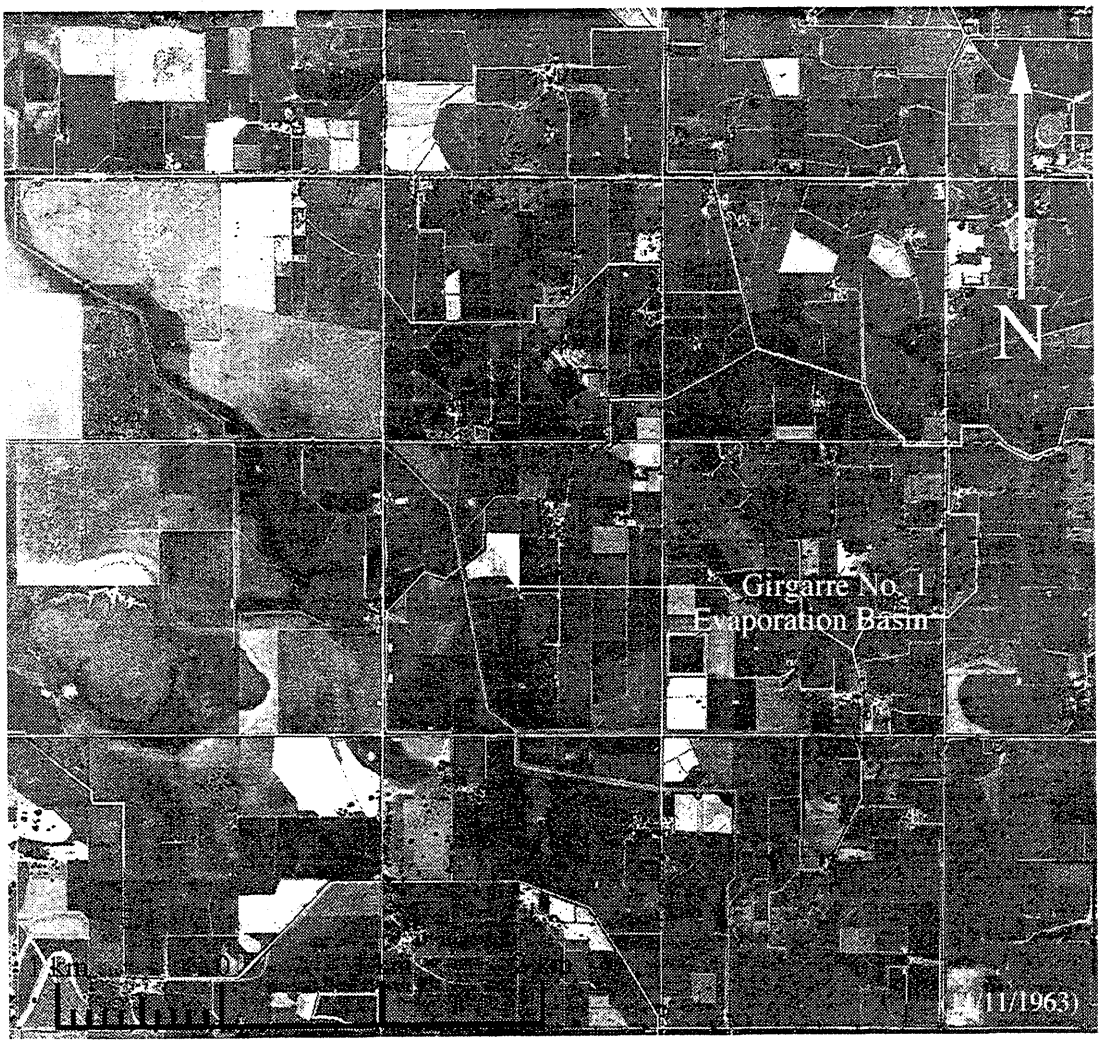
<**Ranking of sustainability**> The main requirement for sustainability would be for the removal of salt from the crystallisation basin. The estimated salt load to the basin is 3000 tonnes per year. Current estimates of the basin life are a minimum of 40 years assuming zero seepage, but are highly dependant on factors such as seepage, inflow salinity, and the basin salt retention rate (RWC, Tatura).

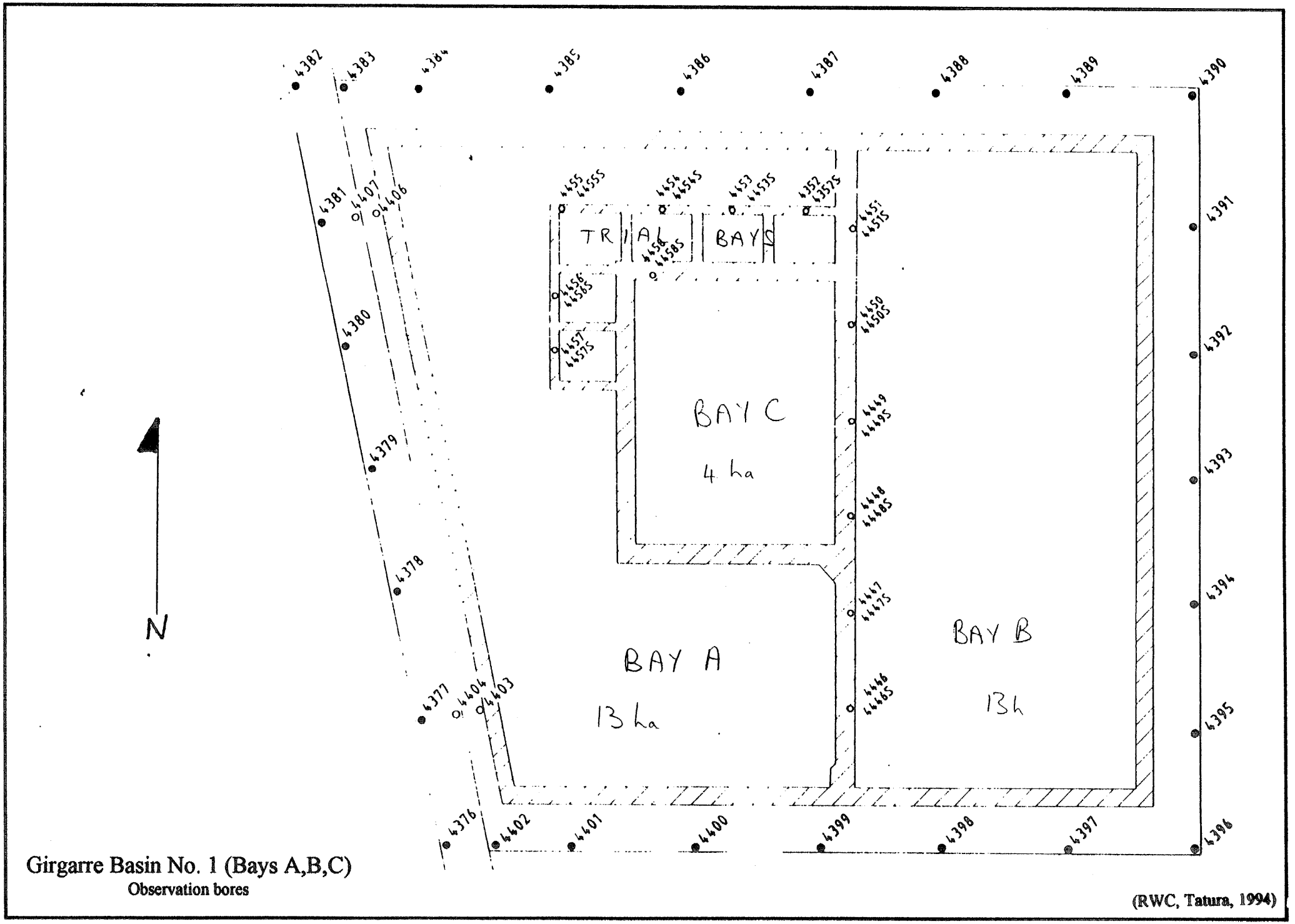
References Cited

Ife, D., 1988- Hydrogeological mapping of the Upper Shepparton Formation, Shepparton Region., Rural Water Commission of Victoria, Report No. 1988/29., 41 p.

Ife, D., 1984- Salinisation and groundwater studies in the Shepparton Region., Unpublished M.App.Sc. thesis, University of NSW

Rural Water Corporation (RWC) Tatura, 1994- Girgarre Evaporation Basin, Unpublished.


N
Girgarre No. 1
Evaporation Basin
(11/1963)



Girgarre Basin No. 1 (Bays A,B,C)

Observation bores

(RWC, Tatura, 1994)

<Site Name> Gunbower
<Synonyms>

Spatial

<**Location description**> 3.5 kilometres NW of Gunbower, Victoria and 5 kilometres SW of Leitchville, Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Deniliquin

<**Location 1:100 000**> Cohuna 7726

<**Zone**> 55

<**Coordinates easting (AMG)**> 259500

<**Coordinates northing (AMG)**> 6019000

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 10 ha

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> <84 m AHD (estimated)

<**Groundwater level (m AHD)**> 86 m AHD (Williams and Woolley, 1992)

<**Groundwater seepage/discharge**> Discharge

<**Average annual evaporation**>

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**> >200,000 EC (RWC, 1993a)

<**Sources of water to be disposed**>

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> Gunbower
<Synonyms>

Engineering/Admin

<**Public or private operation**> Private

<**Agency responsible**> Landowner

<**Project name**> Gunbower

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is located east of Kow Swamp within the flat lying terrain of the Shepparton Formation floodplain. It is surrounded by farm land and cleared forest.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is west of the Cadell Fault and northeast of Mount Hope (Lawrence and Macumber, 1974).

<**Stratigraphic setting**> The basin is floored by the Shepparton Formation (90 m) and underlain by the Parilla Sand (15 m), and the Renmark Group (50 m) (Geology interpreted from Williams and Woolley, 1992).

<**Host formation**> Shepparton Formation

<**Host lithofacies**> Clays and silts

<**Aquitard**> Shepparton Formation

<**Aquitard lithofacies**> Clays and silts

<**Aquifer**> Shepparton Formation and Calivil Formation

<**Aquifer lithofacies**> Shepparton Formation: Isolated sand bodies within the Shepparton Formation: Calivil Formation: Gravel and coarse sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 7.5 kilometres

<**Head between basin and river/tributary**>

<**Direction of groundwater flow in regional aquifer**> NNW to Gunbower Creek (Williams and Woolley, 1992)

<Site Name> Gunbower
<Synonyms>

<kv of artificial floor>

<kv and kh of host> Shepparton Formation: Kv = 0.06 to 0.28 m/day average of 0.18 m/day at a depth of 1.8 to 2.5 metres (McConachy, 1991)

<kv and kh of aquitard> Shepparton Formation: Kv = 0.06 to 0.28 m/day average of 0.18 m/day at a depth of 1.8 to 2.5 metres (McConachy, 1991)

<Thickness of aquitard> 90 metres

<kv and kh of aquifer> Calivil Formation: Kh = 30-50 m/day (Williams and Woolley, 1992)

<EC of aquifer>

<Porosity of aquifer>

<Thickness of aquifer> Calivil Formation 15 metres; Shepparton Formation: Variable depending on the presence or absence of sand bodies

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin has the capacity to receive discharge from the Shepparton Formation, however because of the thick deposit (70-80 metres) of clay and silt within the Shepparton Formation little or no discharge occurs. The amount of disposal is unknown, but it must be low because of the high salinities within the basin (>200,000 EC), which suggest that inflow is less than evaporation. There should be no leakage from the basin although the highly saline water may raise the local watertable.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

<Site Name> Gunbower
<Synonyms>

Interpretive 2

<Ranking of sustainability>

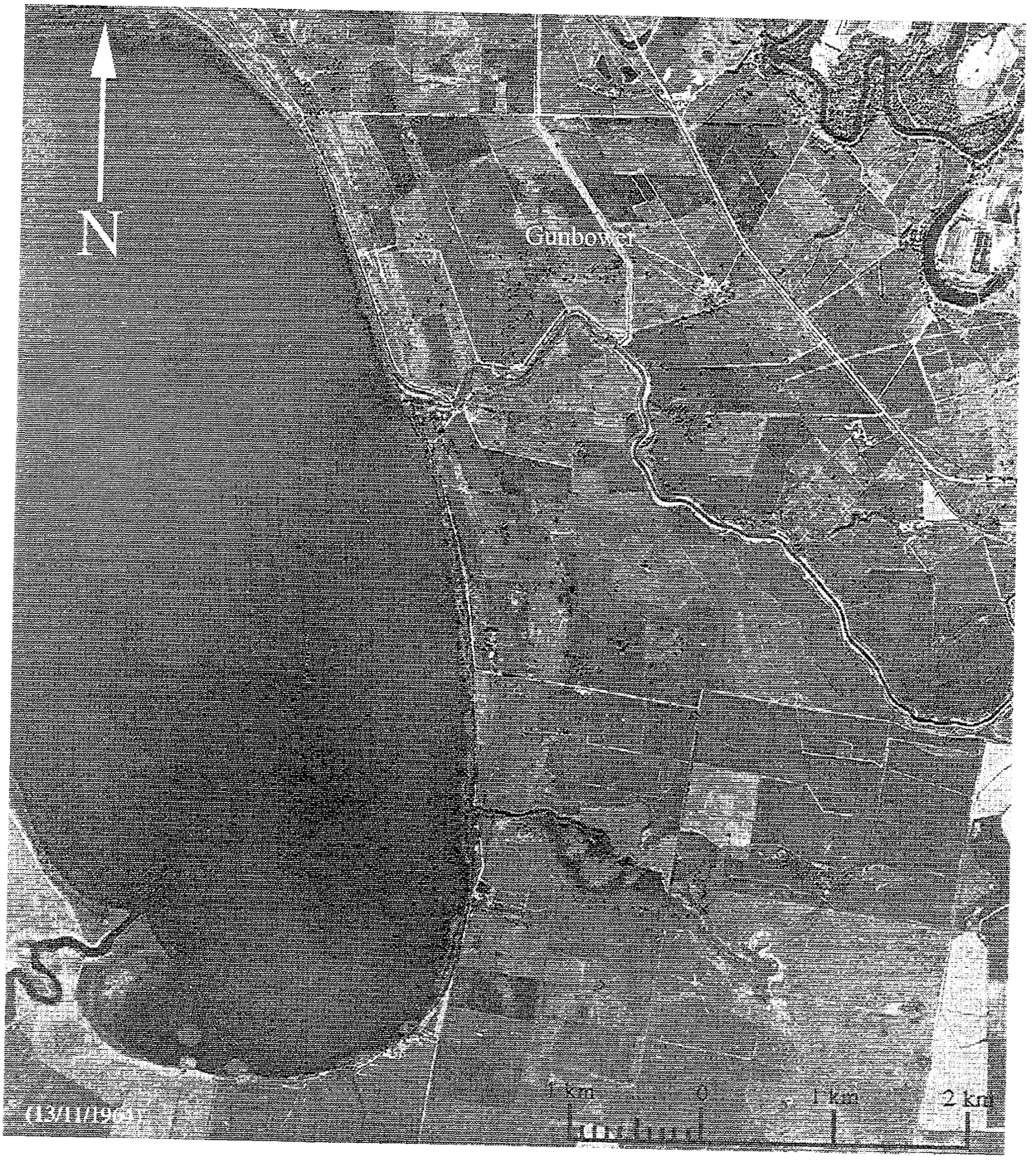
References Cited

Lawrence, C.R., and Macumber, P.G., 1974- Swan Hill Geological Map (1:250,000 scale)., Geological Survey of Victoria

McConachy, F., 1991- Design of an evaporation basin and tile drainage demonstration site on the Tragowel Plains., Rural Water Corporation, Unpublished report

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Williams, R.M. and Woolley, D. Department of Water Resources, 1992- Deniliquin Hydrogeological Map (1:250 000 scale), Australian Geological Survey Organisation, Canberra, Australia


N
Gunbower
1 km
0
1 km
2 km

<Site Name> Hall/Dyson
<Synonyms>

Spatial

<Location description> 5 kilometres south of Dareton, NSW and 4 kilometres NW of Merbein, Victoria

<Located in Murray Trench> Yes

<Location 1:250 000> Mildura

<Location 1:100 000> Mildura 7329

<Zone> 54

<Coordinates easting (AMG)> 595100

<Coordinates northing (AMG)> 6222222

<State> Victoria

General

<Year begun operation>

<Active/inactive>

<Full surface area (ha)> 1.5 ha

<Volume capacity (ML)>

<Full surface level (m AHD)>

<Groundwater level (m AHD)> 35 m AHD (RWC, 1991)

<Groundwater seepage/discharge>

<Average annual evaporation> 1980 mm/yr Class A pan Red Cliffs

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)>

<Sources of water to be disposed> Irrigation discharge

<Terminal/throughflow basin>

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> Hall/Dyson
<Synonyms>

Engineering/Admin

<Public or private operation> Private

<Agency responsible>

<Project name> Hall/Dyson

<Natural, modified natural or constructed>

<Modification type and degree>

Geological

<Site description and Geomorphology> The basin is located along the Murray River between Brickworks Billabong and Cowanna Billabong.

<Subsurface investigations at site>

<Structural setting> The basin is on the Merbein Ridge northwest of the Danyo Fault and east-southeast of the Yelta Fault (Thorne, Hoxley, and Chaplin, 1990).

<Stratigraphic setting> The basin is floored by the Coonambidgal Formation (10 m), and is underlain by the Channel Sand (Monoman Formation) (15-20 m), the Parilla Sand (30 m), the Bookpurnong Beds, the Murray Group Limestone, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<Host formation> Coonambidgal Formation

<Host lithofacies> Fine sand, clayey sand, sandy clay, and clay

<Aquitard> Coonambidgal Formation, Bookpurnong Beds

<Aquitard lithofacies> Coonambidgal Formation: sandy clay and clay

<Aquifer> Channel Sand and Parilla Sand (Connected in trench)

<Aquifer lithofacies> Fine to coarse sand

<Comments>

Summary of Hydrodynamics

<Distance to Murray or tributary> <500 metres

<Head between basin and river/tributary> On floodplain

<Site Name> Hall/Dyson
<Synonyms>

<Direction of groundwater flow in regional aquifer> North to northeast towards the river (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Coonambidgal Formation: 5-10 metres

<kv and kh of aquifer> Kh = 2 m/day (Worst case) (Hoxley, 1991)

<EC of aquifer> > 20,000 mg/L TDS

<Porosity of aquifer>

<Thickness of aquifer> Channel Sand and Parilla Sand: 40-45 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Hall/Dyson should cause few problems if it is kept at or below the level of the river which will act to eliminate leakage into the Channel Sand. The amount of disposal is unknown, but the basin may receive groundwater discharge from the irrigation mound similar to Brickworks and Cowanna Billabong.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

<Site Name> Hall/Dyson
<Synonyms>

Interpretive 2

<Ranking of sustainability>

References Cited

Hoxley, G., 1991- Hydrogeological summary of wetland areas in the Sunraysia Salinity Management Plan Area., Rural Water Corporation, Groundwater Section, Technical note 1

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
Cowanna Billabong
Hall Dyson
Brickworks Billabong
Lamberts Swamp
(30/10/1968)

<Site Name> Hards
<Synonyms>

Spatial

<**Location description**> 1 kilometre SSE of Karadoc Swamp and 3.8 kilometres NW of Iraak, Victoria

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 619600

<**Coordinates northing (AMG)**> 6205000

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 12 ha

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**>

<**Groundwater level (m AHD)**> Channel Sand: 38.1 m AHD, Parilla Sand: 36.7 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<**Groundwater seepage/discharge**> Discharge??

<**Average annual evaporation**> 1980 mm/yr Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**> 5640 mg/L TDS

<**Sources of water to be disposed**> Tile drains

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> Hards
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Hards

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is located within the Murray Trench on top of the Rufus Terrace. It formed in a depression between the longitudinal Woorinen dunes and is surrounded by agricultural land and cleared mallee.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located southeast of the Neckarboo Ridge and northeast of the Wargan Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (5 m) and underlain by the Rufus Formation (3 m), the Channel Sand (6-10 m), the Blanchetown Clay (13 m), the Parilla Sand (80 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Rufus Formation and Blanchetown Clay

<**Aquitard lithofacies**> Rufus Formation: Silt and silty clay; Blanchetown Clay: Clay and clayey silt

<**Aquifer**> Channel Sand and Parilla Sand

<**Aquifer lithofacies**> Channel Sand and Parilla Sand: Coarse to medium grained sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 500 metres

<Site Name> Hards
<Synonyms>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> North towards Karadoc Swamp (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Rufus Formation: 3 metres; Blanchetown Clay: 13 metres

<kv and kh of aquifer> Channel Sand: Kh = 10-40 m/day, Parilla Sand: Kh = 1 m/day (Linke, 1990b)

<EC of aquifer> > 50,000 mg/L TDS (RWC, 1993); Channel Sand: 50,000 EC; Parilla Sand: 30,000 EC (Thorne, Hoxley, and Chaplin, 1990)

<Porosity of aquifer> Channel Sand: 20% (Linke, 1990b)

<Thickness of aquifer> Channel Sand: 6-10 metres; Parilla Sand: 80 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> It is difficult to estimate the potential for leakage of this basin because we don't know the full level or amount of disposal. On the airphoto (30/10/1968), the basin is full which would indicate that inflow is greater than evaporation, which is estimated to be 237.6 ML/yr (1980 mm/yr evaporation x 12 ha). The salinity of the Channel Sand (50,000 EC) is much greater than the salinity of the basin (5640 mg/L TDS) indicating that groundwater is not a large component of the input to the basin. Instead, the basin is probably filled by either tile drains, or from irrigation water perched in the Woorinen Formation. Because there is no input of groundwater from the Channel Sand (the basin is at, or higher than the potentiometric surface of the Channel Sand), and the input of disposal water is higher than the evaporation rate, the basin has the capacity to leak. If water does enter the Channel Sand aquifer it will flow north and be intercepted by Karadoc Swamp, which is a regional groundwater discharge site where it will be evaporated (See Karadoc Swamp entry).

<Hydraulic linkage to surface runoff> The basin probably receives surface runoff from the Woorinen Formation.

<Category - hydraulic stability>

<Site Name> Hards
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

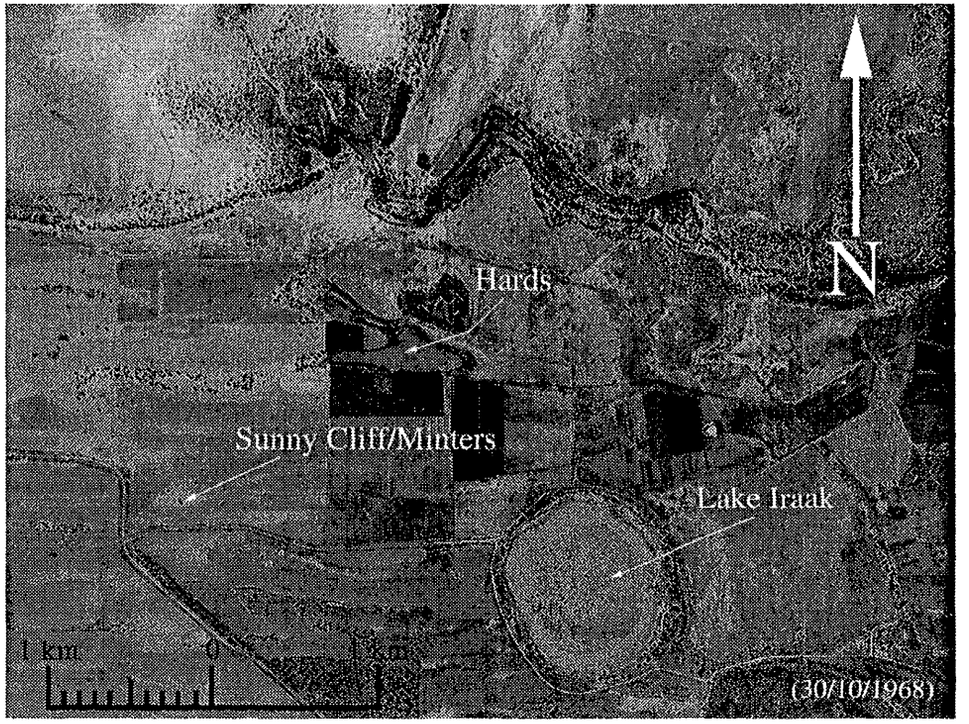
References Cited

Linke, G., 1993- Nangiloc Colignan SMP - Drainage disposal to Karadoc Swamp - CMS Comps., Rural Water Corporation, Unpublished working file No. 93/01895

Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
Hards
Sunny Cliff/Minters
Lake Iraak
1 km
0
1 km
(30/10/1968)

<Site Name> Jacksons-Mat
<Synonyms>

Spatial

<**Location description**> 5 kilometres SSW of Bullock Swamp and 12.2 kilometres ESE of Carwarp, Victoria

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 621700

<**Coordinates northing (AMG)**> 6282400

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 1.0 ha

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> >40 m AHD estimated

<**Groundwater level (m AHD)**> Channel Sand: 39.2 m AHD; Parilla Sand: 37.5 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> Inflow/evaporation > 1.5; 1980 mm/yr Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**> 40 ML/yr

<**Salinity of water disposed (EC)**> 2000 EC

<**Range of salinity in basin (EC)**> 177,700 mg/L TDS

<**Sources of water to be disposed**> Tile Drains

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**> To be made obsolete next year.

<Site Name> Jacksons-Mat
<Synonyms>

Engineering/Admin

<Public or private operation> Private

<Agency responsible>Landholder

<Project name> Jacksons-Mat

<Natural, modified natural or constructed> Natural

<Modification type and degree> None

Geological

<Site description and Geomorphology> The basin is located within the Murray Trench and sits on top of the Rufus Terrace. It is built within a depression of the longitudinal Woorinen dunes and is surrounded by uncleared mallee.

<Subsurface investigations at site>

<Structural setting> The basin lies within the Raak Trough (Thorne, Hoxley, and Chaplin, 1990).

<Stratigraphic setting> The basin is floored by the Woorinen Formation (5-10 m), and is underlain by the Rufus Formation (3-5 m), the Channel Sand (5-7 m), the Blanchetown Clay (32 m), the Parilla Sand (67 m), the Bookpurnong beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<Host formation> Woorinen Formation

<Host lithofacies> Red silt and sand

<Aquitard> Rufus Formation and Blanchetown Clay

<Aquitard lithofacies> Rufus Formation: Silt and silt clay; Blanchetown Clay: Clay and silt

<Aquifer> Channel Sand and Parilla Sand

<Aquifer lithofacies> Channel Sand and Parilla Sand: Medium to coarse sand

<Comments>

Summary of Hydrodynamics

<Distance to Murray or tributary> 3 kilometres

<Site Name> Jacksons-Mat
<Synonyms>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Northeast towards the river (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Rufus Formation: 3-5 metres; Blanchetown Clay: 32 metres

<kv and kh of aquifer> Channel Sand: Kh = 40 m/day (Linke, 1993); Parilla Sand: Kh = 1 m/day (Thorne, Hoxley, and Chaplin, 1990).

<EC of aquifer> > 50,000 mg/L TDS (RWC, 1993); Channel Sand: 45,000 EC, Parilla Sand: 25,000 EC (Thorne, Hoxley, and Chaplin, 1990).

<Porosity of aquifer>

<Thickness of aquifer> Channel Sand: 5-7 metres; Parilla Sand: 67 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The potential exists for leakage from the basin because it sits above the potentiometric head within the Channel Sand aquifer. The chance of leakage is further enhanced because the amount of disposal exceeds the amount of evaporation by two to one, providing a large reservoir of water (and resultant higher head) to drive the seepage. Separating the basin from the Channel Sand is the Rufus Formation, which is thought to leak at a rate of 0.4 ML/ha/yr (Linke, 1993). Because of the aquitard the water will spread laterally within the Woorinen Formation forming a large perched aquifer causing potential salinisation of the low lying areas. The perched watertable will grow until it reaches an equilibrium between inflow and downward leakage into the Channel Sand. The water that enters the Channel Sand will flow towards the Murray River driven by the irrigation mound beneath the Nangiloc-Colignan Irrigation Area. The Channel Sand is in hydraulic contact with the Murray River allowing point source entry of the saline water to the river. The Rural Water Corporation plans to make the basin obsolete in 1994.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> Jacksons-Mat
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus> The rate of evaporation is half the rate of disposal.

Interpretive 2

<Ranking of sustainability>

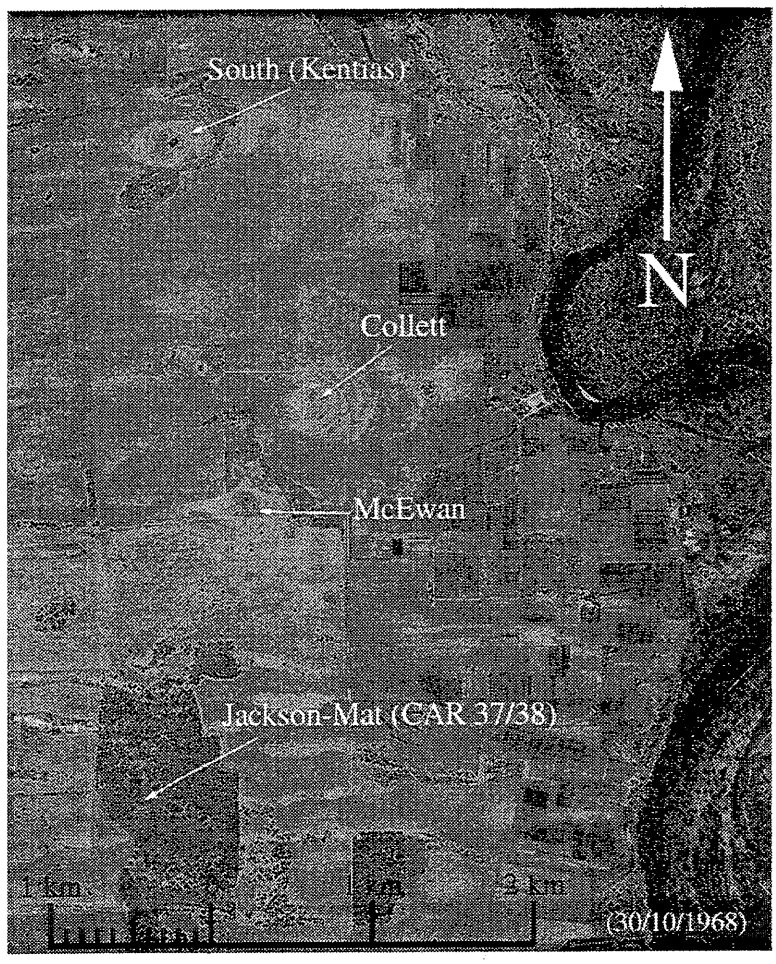
References Cited

Linke, G., 1993- Nangiloc Colignan SMP - Drainage disposal to Karadoc Swamp - CMS Comps., Rural Water Corporation, Unpublished working file No. 93/01895

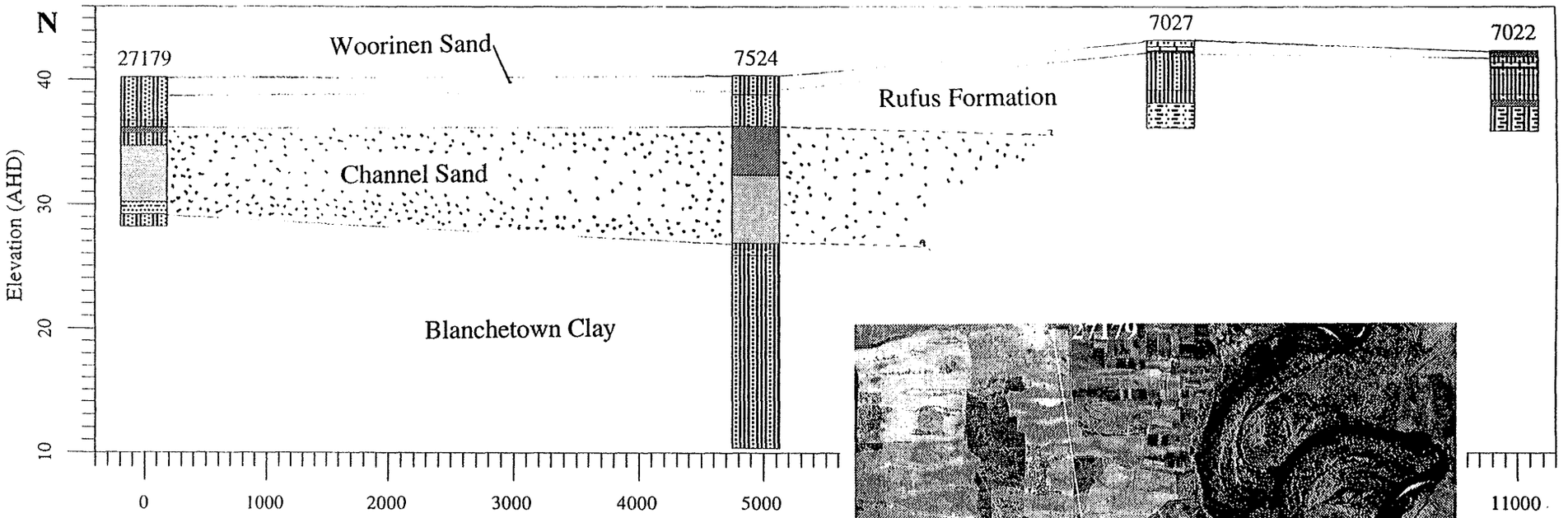
Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

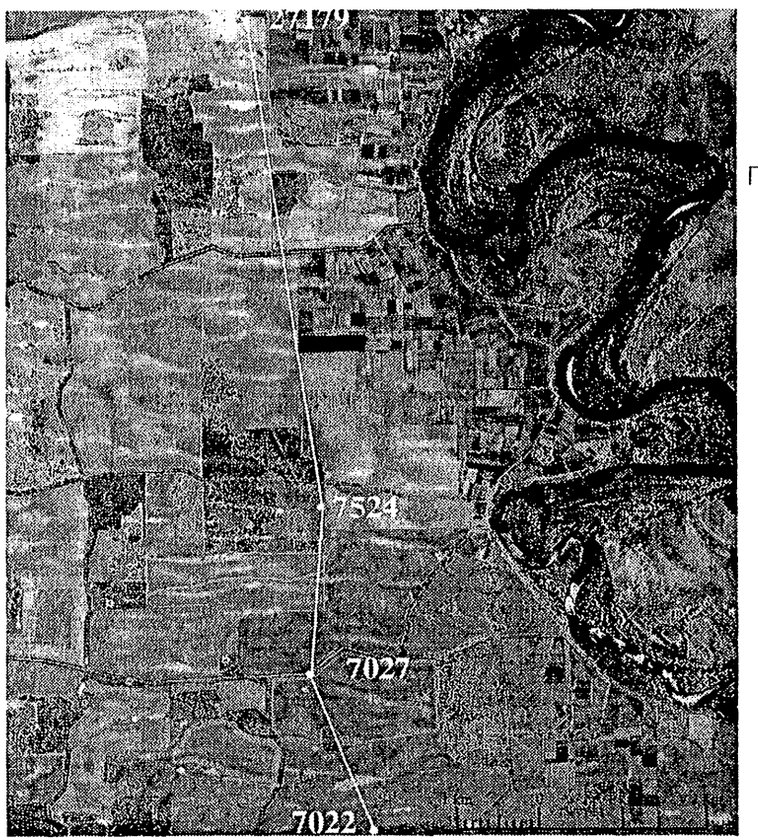
Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


South (Kentias)
N
Collett
McEwan
Jackson-Mat (CAR 37/38)
1 km
2 km
(30/10/1968)

Jacksons-Mat, Castles Crossing, John, and Bothroyd Dick



V/H 100



<Site Name> John
<Synonyms>

Spatial

<**Location description**> 3 kilometres west of Colignan, Victoria and 13 kilometres NE of Nowingi, Victoria

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Nowingi 7328

<**Zone**> 54

<**Coordinates easting (AMG)**> 623800

<**Coordinates northing (AMG)**> 6178200

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 3 ha

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> 42 m AHD (RWC map 147161)

<**Groundwater level (m AHD)**> Channel Sand: 39.3 m AHD; Parilla Sand: 37.5 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> 1980 mm Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**> 30 ML

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**> 193,200 EC

<**Sources of water to be disposed**> Tile Drains

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> John
<Synonyms>

Engineering/Admin

<**Public or private operation**> Private

<**Agency responsible**> Landholder

<**Project name**> John

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is located within the trench and sits on the Rufus Terrace. It is built in a depression within the longitudinal Woorinen dunes and surrounded by both cleared and uncleared mallee.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is within the Raak Trough (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> Th basin is floored by the Woorinen Formation (5-10 m), and underlain by the Rufus Formation (5 m), the Channel Sand (5-7 m), the Blanchetown Clay (31 m), the Parilla Sand (65 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Rufus Formation and Blanchetown Clay

<**Aquitard lithofacies**> Rufus Formation: Silt and silt clay; Blanchetown: Clay and silt

<**Aquifer**> Channel Sand and Parilla Sand

<**Aquifer lithofacies**> Channel Sand and Parilla Sand: Coarse to medium quartz sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 2.5 kilometres

<Site Name> John
<Synonyms>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> East towards the river (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Rufus Formation: 5 metres; Blanchetown Clay: 31 metres

<kv and kh of aquifer> Channel Sand: Kh = 40 m/day (Linke, 1993); Parilla Sand: Kh = 1 m/day (Thorne, Hoxley, and Chaplin, 1990)

<EC of aquifer> > 50,000 mg/L TDS (RWC, 1993); Channel Sand: 45,000 EC, Parilla Sand: 20,000 EC (Thorne, Hoxley, and Chaplin, 1990)

<Porosity of aquifer>

<Thickness of aquifer> Channel Sand: 5-7 metres; Parilla Sand: 65 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin has the potential to leak into the Channel Sand aquifer because with disposal it has a higher potentiometric surface than the Channel Sand. This is counteracted by the low permeability of the Rufus Formation which is thought to leak at a rate of 0.4 ML/ha/yr restricting flow into the aquifer. Second, the potential amount of evaporation 59.4 ML/yr (1980 mm/yr evaporation by 3 ha) is twice as high as the amount of input (30 ML/yr). This is also supported by the extremely high salinities in the basin (193,200 EC) showing evidence of evaporative concentration. If the brine is able to enter the Channel Sand, it will be carried towards the river by the pressure of the irrigation mound in the Channel Sand. At the river the Channel Sand is in direct contact with the Murray River providing a conduit for point source salt accessions. More local problems may also be encountered because of leakage from the basin into the perched watertable in the Woorinen Formation.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> John
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

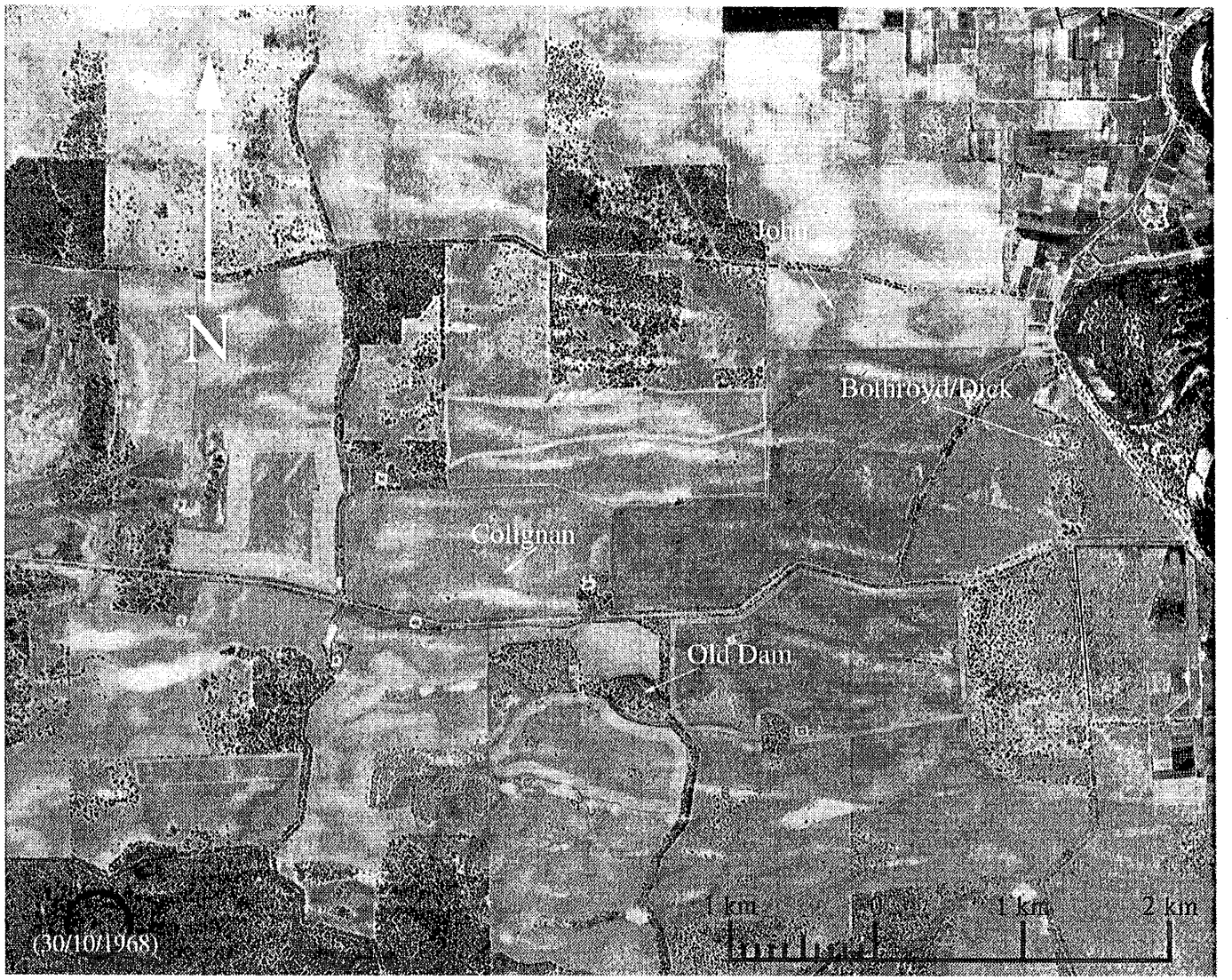
References Cited

Linke, G., 1993- Nangiloc Colignan SMP - Drainage disposal to Karadoc Swamp - CMS Comps., Rural Water Corporation, Unpublished working file No. 93/01895

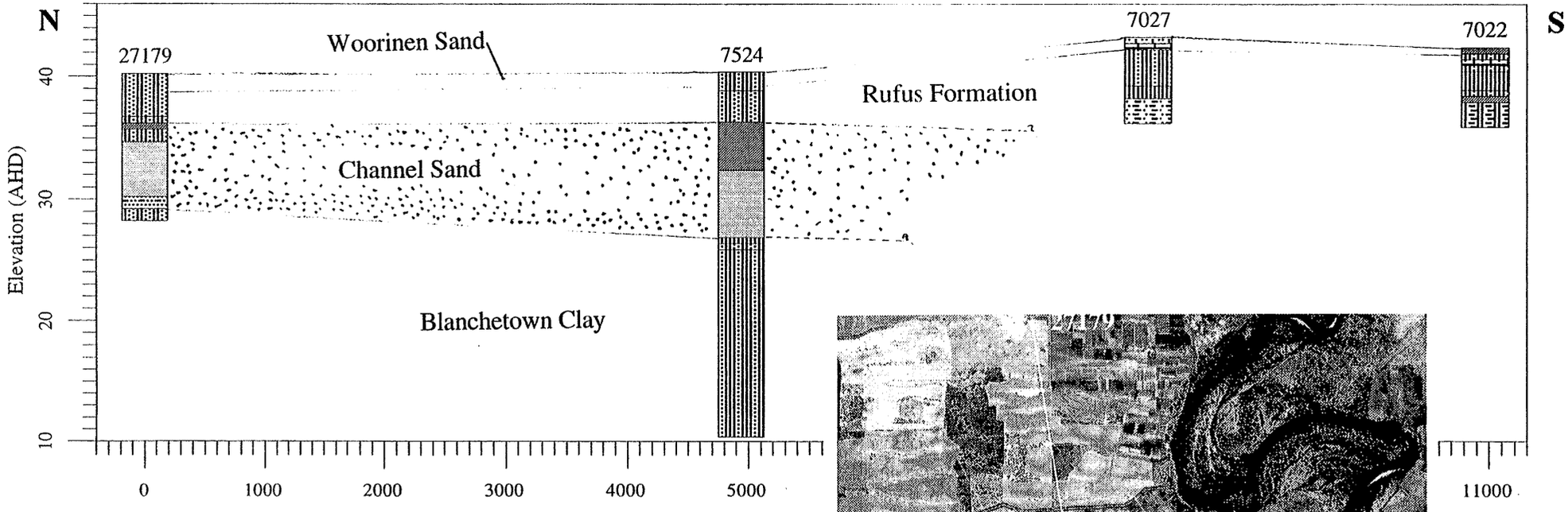
Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
John
Bothroyd/Dick
Colignan
Old Dam
1 km
0
1 km
2 km
(30/10/1968)

Jacksons-Mat, Castles Crossing, John, and Bothroyd Dick



V/H 100



<Site Name> Karadoc Swamp
<Synonyms>

Spatial

<**Location description**> 12 kilometres SE of Red Cliffs, Victoria and 5 kilometres NW of Iraak, Victoria

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 617600

<**Coordinates northing (AMG)**> 6197800

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 855 ha

<**Volume capacity (ML)**> 2725 ML

<**Full surface level (m AHD)**> 36.67 m AHD

<**Groundwater level (m AHD)**> Channel Sand: 37.5 to 35.7 m AHD; Parilla Sand: 36.8 to 35.8 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<**Groundwater seepage/discharge**> Seepage and Discharge

<**Average annual evaporation**> Inflow/evaporation = 0.15

<**Volume disposed annually (ML/yr)**> 837 ML/yr; 775 ML/yr (Linke, 1993)

<**Salinity of water disposed (EC)**> 2000 EC

<**Range of salinity in basin (EC)**> 172,800 EC

<**Sources of water to be disposed**> Tile Drains and groundwater discharge

<**Terminal/throughflow basin**> Throughflow

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**> Tile drain disposal is on the floodplain (C. Thompson pers. comm.)

<**Site Name**> Karadoc Swamp
<**Synonyms**>

Engineering/Admin

<**Public or private operation**> Private

<**Agency responsible**> Landholders

<**Project name**> Karadoc Swamp

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is located in the Murray Trench and is surrounded by and has deflated through the Rufus Terrace. The deflation has formed a lunette on the eastern margin of the basin, while the basin continues to receive discharge from the south. Connection to the Murray River is by Inlet Creek and outfall is by Outlet Creek.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located on Neckarboo Ridge and is northeast of the Wargan Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation/Yamba Formation/Coonambidgal Formation (5 m) and is underlain by the Channel Sand (8-10 m), the Blanchetown Clay (0-12 m), the Parilla Sand (80-85 m), the Bookpurnong beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation/Yamba Formation/Coonambidgal Formation

<**Host lithofacies**> The basin floor is a complex mixture of red sand and silt blown in from the Woorinen Formation, salt and gypsum from evaporated water, and present day clays and silts from when the Murray River floods (basin is covered in 60,000 ML/day flow: 1 in 3 years) (Linke, 1993)

<**Aquitard**> Woorinen Formation/Yamba Formation/Coonambidgal Formation and Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Woorinen Formation/Yamba Formation/Coonambidgal Formation: silt, clay, and sand; Blanchetown Clay: clay; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand.

<**Aquifer**> Channel Sand and Parilla Sand

<**Aquifer lithofacies**> Channel Sand and Parilla Sand: Fine to medium sand

<**Comments**>

<Site Name> Karadoc Swamp
<Synonyms>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 2 kilometres, although basin is flooded by 1 in 3 year floods (60,000 ML/day).

<**Head between basin and river/tributary**>

<**Direction of groundwater flow in regional aquifer**> The groundwater flows north into the basin and then turns northeast towards the river (RWC, 1991).

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**>

<**Thickness of aquitard**> Woorinen Formation/Yamba Formation/Coonambidgal Formation: 5 metres; Blanchetown Clay: 0-12 metres; Upper Parilla Sand: 3-5 metres

<**kv and kh of aquifer**> Channel Sand: Kh = 10-40 m/day, Parilla Sand:: Kh = 1 m/day (Linke, 1990b)

<**EC of aquifer**> > 50,000 mg/L TDS (RWC, 1993); Channel Sand: 40,000-50,000 EC; Parilla Sand: 30,000-40,000 EC (Thorne, Hoxley, and Chaplin, 1990); Parilla Sand: 40,000-50,000 EC (Linke, 1993)

<**Porosity of aquifer**> Channel Sand: 20% (Linke, 1990b)

<**Thickness of aquifer**> Channel Sand: 8-10 metres; Parilla Sand: 80-85 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> Karadoc Swamp is complex both structurally and stratigraphically. In the south the basin receives groundwater discharge from the Channel Sand while in the north there is potential seepage. The Blanchetown Clay underlies the southern part of the basin and separates the Channel Sand from the Parilla Sand. In the northeastern corner of Karadoc Swamp the Channel Sand lies directly on the Upper Parilla Confining Layer and the two aquifers are at the same potentiometric level, suggesting some degree interconnection.

The basin receives 325 ML/yr of groundwater discharge from the Channel Sand (90% of available water) at an average salinity of 30,000 mg/L. It also receives 400 ML of runoff from the perched watertable in the Woorinen Formation, and 50 ML/yr of Tile drainage, for a total of 775 ML/yr. The basin has an evaporative capacity of over 16,000 ML/yr (1980 mm/yr x 840 ha) so it is normally dry. The floor of the basin is an admixture of the Woorinen Formation, the Coonambidgal Formation, and the Yamba Formation, which acts to isolate the Channel Sand aquifer. The effectiveness of the lake bed as an aquitard can be severely lessened if it is allowed to dry out and form mudcracks, which then act to funnel water to the Channel Sand (Linke, 1993).

The basin is assumed to leak at 1-2 ML/day (Linke, 1993), however these cracks may allow greater amount of water to enter the aquifer especially during wet periods when there is more water in the basin. The saline groundwater is then able to enter the Murray River which is in hydraulic contact with the Channel Sand.

<Site Name> Karadoc Swamp
<Synonyms>

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus> Evaporation 16,632 Ml/yr (1980 mm/yr x 840 ha) - input 775-837 Ml/yr

Interpretive 2

<Ranking of sustainability>

References Cited

Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

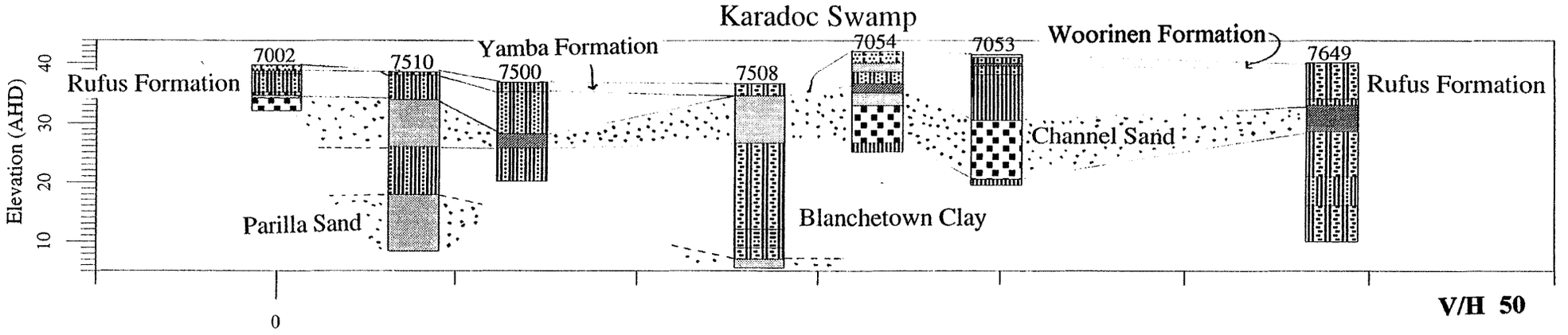
Linke, G., 1993- Nangiloc Colignan SMP - Drainage disposal to Karadoc Swamp - CMS Comps., Rural Water Corporation, Unpublished working file No. 93/01895

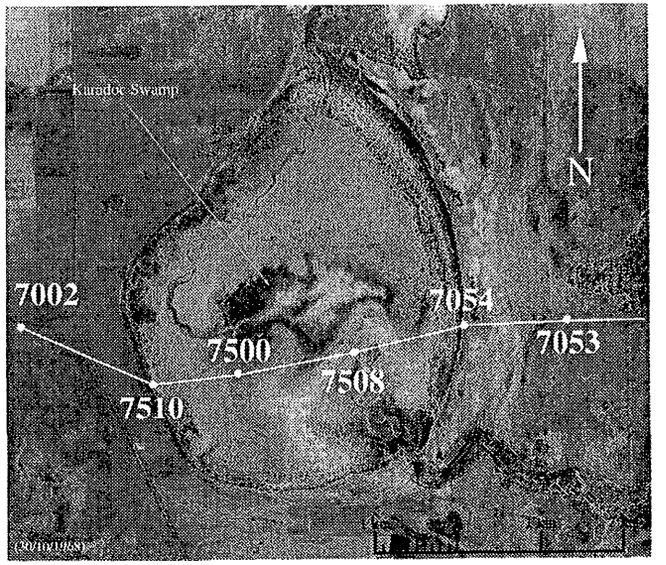
Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.

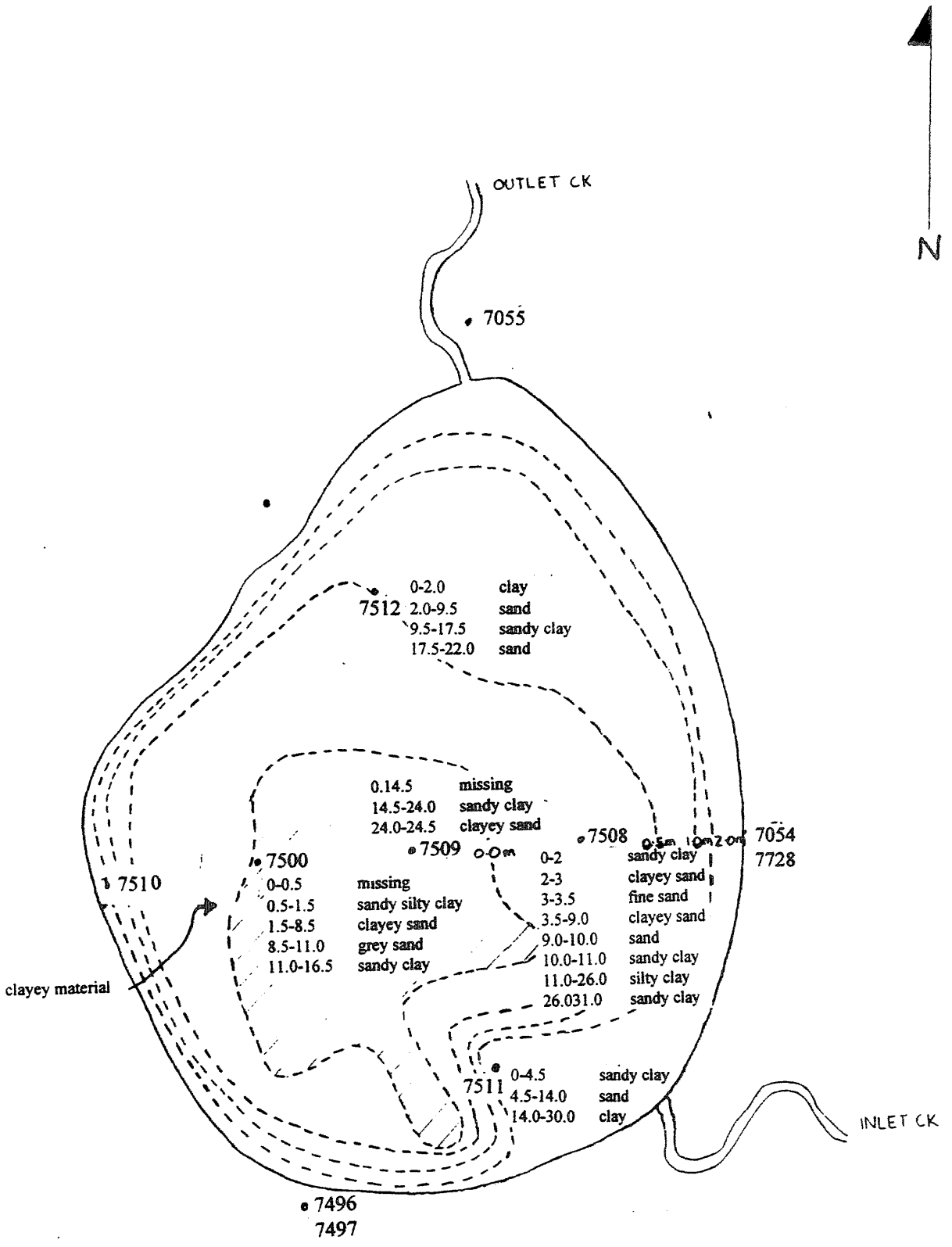

Karadoc Swamp
N
1 km
2 km
(30/10/1968)


Karadoc Swamp
Yamba Formation
Woorinen Formation
Rufus Formation
Rufus Formation
Channel Sand
Parilla Sand
Blanchetown Clay
Elevation (AHD)
40
30
20
10
0
7002
7510
7500
7508
7054
7053
7649
V/H 50


Karadoc Swamp
N
7002
7510
7500
7508
7054
7053

Karadoc Swamp

Depth to piezometric surface (20/8/80)



(Linke, 93 TN)

<Site Name> Kentias Basin
<Synonyms> South Basin
Nangiloc Basin

Spatial

<Location description> 1.5 kilometres SW of Bullock Swamp and 4 kilometres NW of Nangiloc, Victoria

<Located in Murray Trench> Yes

<Location 1:250 000> Mildura

<Location 1:100 000> Mildura 7329

<Zone> 54

<Coordinates easting (AMG)> 622000

<Coordinates northing (AMG)> 6186000

<State> Victoria

General

<Year begun operation> 1975

<Active/inactive> Active

<Full surface area (ha)> 1.9 ha

<Volume capacity (ML)> 144 ML

<Full surface level (m AHD)> 39 m AHD

<Groundwater level (m AHD)> 38 m AHD

<Groundwater seepage/discharge> Seepage

<Average annual evaporation>

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)> 2000 EC

<Range of salinity in basin (EC)> 178,300 mg/L TDS

<Sources of water to be disposed> Nangiloc South

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> Kentias Basin
<Synonyms> South Basin
Nangiloc Basin

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> South (Kentias)

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is located within the trench on the Rufus Terrace in a depression in the Woorinen dunefield.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located within the Raak Trough (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (3-5 m) (and perhaps some Yamba Formation as well), and is underlain by the Rufus Formation (7-10 m), the Channel Sand (5-10 m), the Blanchetown Clay (30-35 m), the Parilla Sand, (65 m), the Bookpurnong Beds/Geera clay, the Murray Group Limestone, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Rufus Formation and Blanchetown Clay

<**Aquitard lithofacies**> Rufus Formation: Silts and clay; Blanchetown Clay: Clay

<**Aquifer**> Channel Sand and Parilla Sand

<**Aquifer lithofacies**> Channel Sand and Parilla Sand: Medium to coarse quartz sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 2.5 kilometres

<**Site Name**> Kentias Basin
<**Synonyms**> South Basin
Nangiloc Basin

<**Head between basin and river/tributary**>

<**Direction of groundwater flow in regional aquifer**> ENE towards the river (RWC, 1991)

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**>

<**Thickness of aquitard**> Rufus Formation: 7-10 metres; Blanchetown Clay: 30-35 metres

<**kv and kh of aquifer**> Channel Sand: Kh = 40 m/day (Linke, 1993)

<**EC of aquifer**> > 50,000 mg/L TDS

<**Porosity of aquifer**>

<**Thickness of aquifer**> Channel Sand: 5-10 metres; Parilla Sand: 65 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> The basin may act as a discharge zone when it is empty, however when full it seeps. The leakage may cause two potential problems. First, Budahazy and Thompson (1992) have shown that the perched watertable (within the Woorinen Formation and on top of the Rufus Formation) without disposal to be within 0-1 metre of the surface directly beneath the basin, while with disposal the mound increases in size causing potential salinisation to an area about 500 metres around the basin. Second, water that seeps through the Rufus Formation will enter the Channel Sand aquifer which is in direct contact with the River Murray, however any input to the river will be small due to amount of water the basin receives.

<**Hydraulic linkage to surface runoff**> Surface water forms a perched aquifer in the Woorinen Formation.

<**Category - hydraulic stability**>

<**Category - degree of hydraulic isolation**>

<Site Name> Kentias Basin
<Synonyms> South Basin
Nangiloc Basin

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

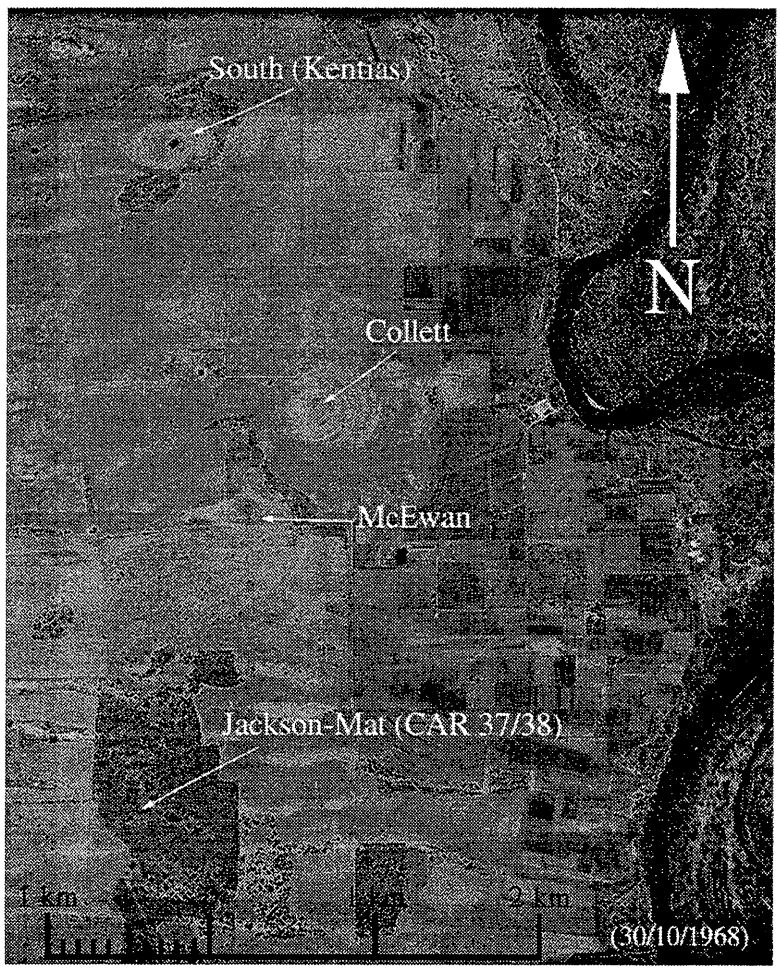
Budahazy, M., and Thompson, M., 1992- Nangiloc-Colignan Salinity Management Plan Investigation of basins for use as drainage disposal basins., Rural Water Corporation, Unpublished report 1992/15

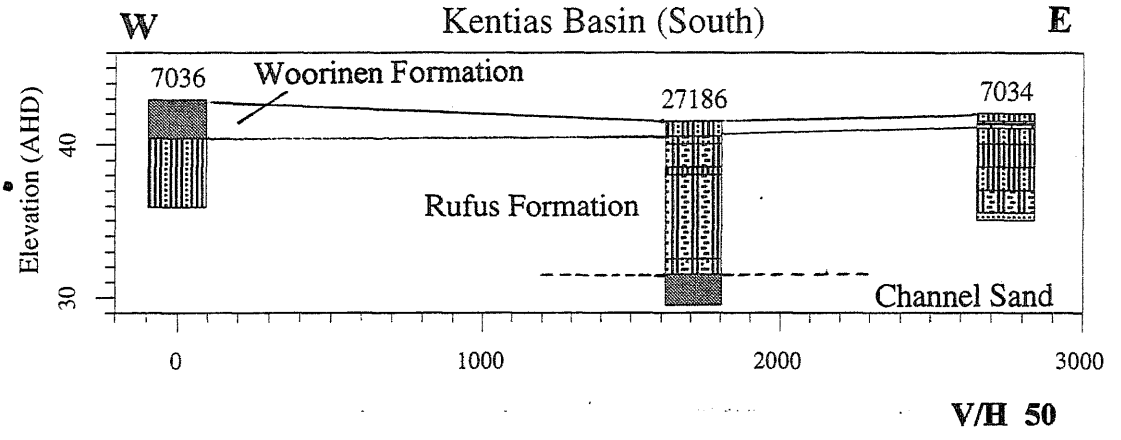
Linke, G., 1994b- Nangiloc-Colignan McEwans, Kentia, and Colletts Basins - Evaporation capacity., Unpublished working file No. 02/00859

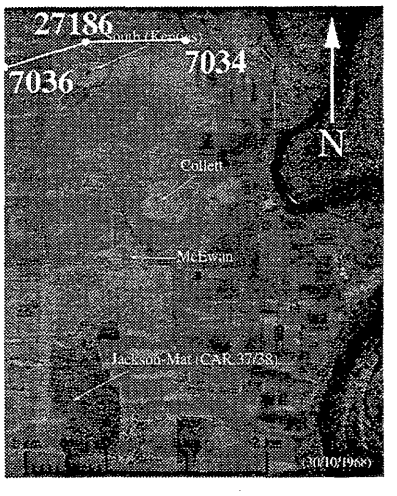
Linke, G., 1993- Nangiloc Colignan SMP - Drainage disposal to Karadoc Swamp - CMS Comps., Rural Water Corporation, Unpublished working file No. 93/01895

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

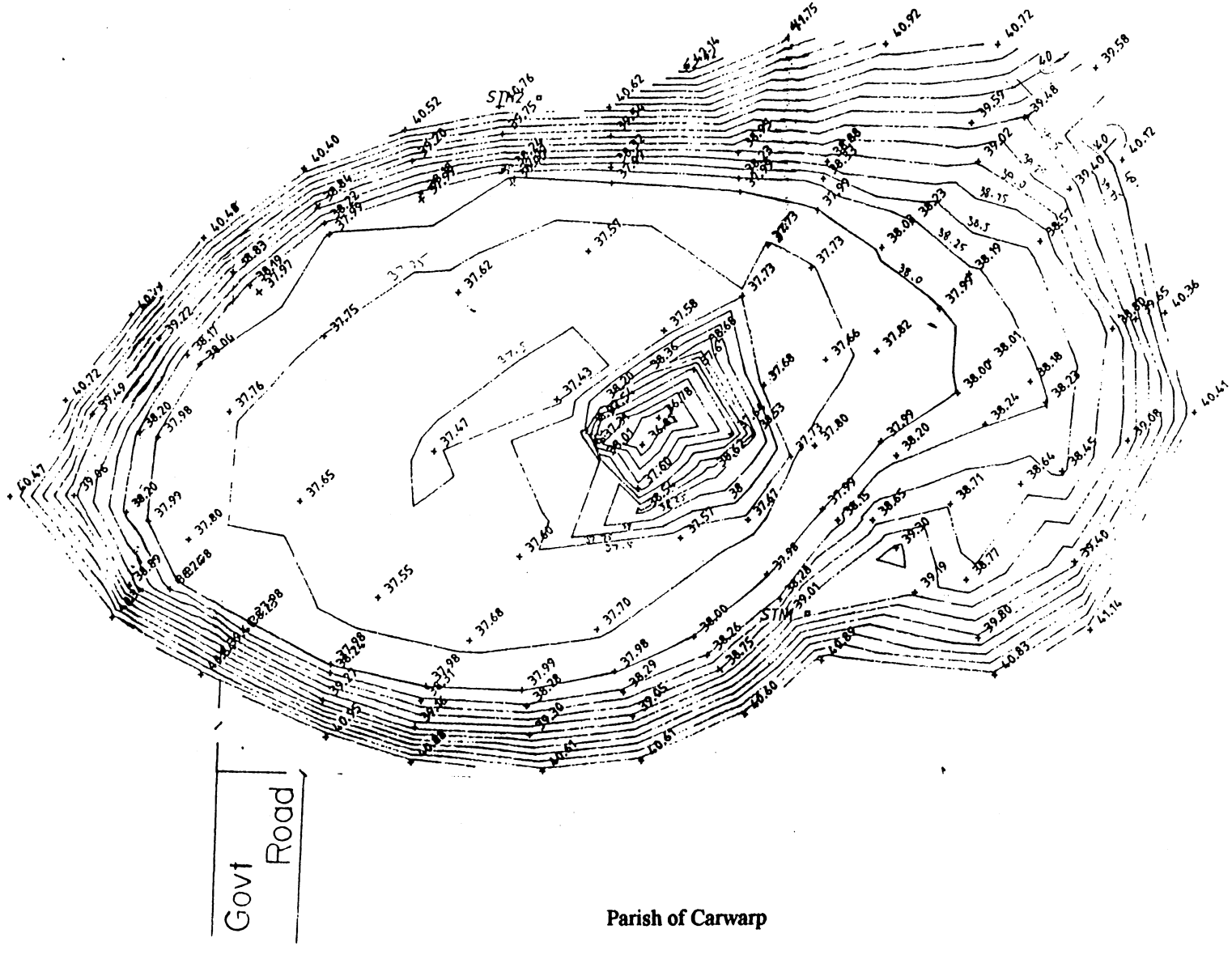
Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


South (Kentias)
N
Collett
McEwan
Jackson-Mat (CAR 37/38)
1 km
2 km
(30/10/1968)


W
Kentias Basin (South)
E
7036
Woorinen Formation
27186
7034
Rufus Formation
Channel Sand
Elevation (AHD)
40
30
0
1000
2000
3000
V/H 50


27186
7036
7034
N
Collett
McEwan
Jackson-Mat (CAR 37/38)

Kentias Basin (Nangiloc or South)



Scale 1:20,000 reduced to A4

Geocomp file 5006
Refer F4108/51

Parish of Carwarp

(RWC files)

<Site Name> Lake Batyo Catyo
<Synonyms>

Spatial

<Location description>

<Located in Murray Trench>

<Location 1:250 000>

<Location 1:100 000>

<Zone>

<Coordinates easting (AMG)>

<Coordinates northing (AMG)>

<State> Victoria

General

<Year begun operation>

<Active/inactive> Active

<Full surface area (ha)>

<Volume capacity (ML)> 2714 ML

<Full surface level (m AHD)> 121.64 m AHD

<Groundwater level (m AHD)>

<Groundwater seepage/discharge> Seepage

<Average annual evaporation>

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)> ~600 EC

<Sources of water to be disposed> Holds irrigation water

<Terminal/throughflow basin>

<Range of elevation of lake surface with disposal>

<Lining/treatment of base>

<Review of environmental impacts>

<Site Name> Lake Batyo Catyo
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Lake Batyo Catyo

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Diversion weir, inlet and outlet channels, and levees

Geological

<**Site description and Geomorphology**>

<**Subsurface investigations at site**>

<**Structural setting**>

<**Stratigraphic setting**> The basin is floored by the Shepparton Formation (40 m), and underlain by the Calivil Formation (30 m?), and Cambrian-Ordovician slates and shales (Linke and Ryan, 1988)

<**Host formation**> Shepparton Formation

<**Host lithofacies**> Calcareous aeolian clay to sandy clay

<**Aquitard**> Shepparton Formation

<**Aquitard lithofacies**> Alluvial grey, red, and brown clays and silts

<**Aquifer**> Shepparton Formation and Calivil Formation

<**Aquifer lithofacies**> Shepparton Formation: thin sand wedges with little lateral continuity; Calivil Formation: ferrunginised, quartz gravel and pebbles with a matrix of clays and silts

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**>

<Site Name> Lake Batyo Catyo
<Synonyms>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Northeast

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> 35 metres

<kv and kh of aquifer>

<EC of aquifer> Shepparton Formation: 20,400-30,800 EC; Calivil Formation: 30,000-40,000 EC (Linke and Ryan, 1988)

<Porosity of aquifer>

<Thickness of aquifer> Shepparton Formation: Variable depending on presence or absence of sand bodies; Calivil Formation: 30 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> There is an immediate reaction in the shallow aquifer within 500 metres of the basin in response to any changes in levels of the lake, except in the north where the response lags. Leakage from the basin is constant at 0.027 m^3/day/linear metre, which has formed a 1 metre high mound under the lake. There is no leakage into the Calivil Formation because it is has an upwards gradient into the Shepparton Formation of 1.5 metes (Linke and Ryan, 1988).

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Site Name> Lake Batyo Catyo
<Synonyms>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Linke, G., and Ryan, S., 1988- Lake Batyo Catyo Salinity Investigation: Technical report., Rural Water Corporation, Unpublished report 1988/11

<Site Name> Lake Hawthorn
<Synonyms>

Spatial

<**Location description**> 5 kilometres WSW of Mildura, Victoria and 4 kilometres SE of Merbein, Victoria.

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 601000

<**Coordinates northing (AMG)**> 6215000

<**State**> Victoria

General

<**Year begun operation**> 1968

<**Active/inactive**> Active

<**Full surface area (ha)**> 214 ha

<**Volume capacity (ML)**> 4405 ML

<**Full surface level (m AHD)**> 35.3 m AHD

<**Groundwater level (m AHD)**> 36 m AHD

<**Groundwater seepage/discharge**> Discharge

<**Average annual evaporation**> Inflow/evaporation > 1.5

<**Volume disposed annually (ML/yr)**> 6680 ML/yr

<**Salinity of water disposed (EC)**> 2000 EC

<**Range of salinity in basin (EC)**> 1683-7254 EC

<**Sources of water to be disposed**> Irrigation drainage

<**Terminal/throughflow basin**> Throughflow

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

Engineering/Admin

<**Public or private operation**> Public

<Site Name> Lake Hawthorn
<Synonyms>

<**Agency responsible**> Rural Water Commission

<**Project name**> Lake Hawthorn

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Levees have been built to separate the Murray River and Lake Hawthorn and pumps take overflow to the Wargan Basins.

Geological

<**Site description and Geomorphology**> The basin is located within the trench on a higher terrace (Rufus Terrace or Coonambidgal Terrace) than the river and originally formed a continuous lake with Lake Ranfurly. There is a large lunette on the eastern margin of the lake that formed during an arid period. During a wet phase overflow from the lake cut a channel through the Rufus Terrace, allowing connection to the river (SR&WSC, 1974).

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located in the Koorlong Trough south east of the Danyo Fault (Thorn, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Yamba Formation (1-2 m), and is underlain by the Rufus Formation (3-5 m), the Blanchetown Clay (15-20 m), the Parilla Sand (20-30 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin in addition to RWC bores, and Cox, 1989. Thorne, Hoxley, and Chaplin site no Yamba Formation or Rufus Terrace, but instead have Lake Hawthorn on the Blanchetown Clay).

<**Host formation**> Yamba Formation (implied from lunette)

<**Host lithofacies**> Lunettes and lacustral clays

<**Aquitard**> Rufus Formation and Upper Parilla Sand or Blanchetown Clay

<**Aquitard lithofacies**> Clay and silty clay

<**Aquifer**> Channel Sand and Parilla Sand

<**Aquifer lithofacies**> Parilla Sand: Fine to coarse sand; Channel Sand: Coarse to medium sand, typically 50% coarse, 36% medium, and 8-10 % fine sand, silt and clay (Cox, 1989)

<**Comments**> Storage for irrigation drainage water which is evaporated and then pumped to Wargan Basins or released into the Murray River during high flows.

Summary of Hydrodynamics

<**Distance to Murray or tributary**> < 100 metres to connect with causeway, actual lake is about 2 kilometres

<**Head between basin and river/tributary**>

<**Direction of groundwater flow in regional aquifer**> Northeast to the river (RWC, 1991)

<Site Name> Lake Hawthorn
<Synonyms>

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Rufus Formation: 4 metres; Upper Parilla Sand: 2-4 metres (Cox, 1989); Blanchetown Clay: 15 metres (Thorne, Hoxley, and Chaplin, 1990)

<kv and kh of aquifer> Channel Sand?: Transmissivity 42-346 m^2/day. Transmissivity varies depending on flow path (SR&WSC, 1974); Transmissivity 228-712 m^2/day (Cox, 1989)

<EC of aquifer> > 50,000 mg/L TDS (RWC, 1993); Channel Sand: 3,000-42,000 mg/L TSS; Parilla Sand: 10,000 mg/L TSS (SR&WSC, 1974)

<Porosity of aquifer>

<Thickness of aquifer> Channel Sand: 4 metres; Parilla Sand: 30 metres (Cox, 1989)

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Groundwater flow around Lake Hawthorn, is controlled by the irrigation mound beneath Mildura. Consequently, the lake receives groundwater discharge on the south and provides recharge in the north. Groundwater within the trench is controlled by the Rufus Formation and the Channel Sand. The Rufus Formation, which acts as a barrier between the lake and the Channel Sand Aquifer, is at best a leaky aquitard because of its lithologic variability, limited spatial distribution, and thinness (3-4 m) ; while the Channel Sand Aquifer, which consists of medium to coarse sand with a high permeability, is in direct contact with the River Murray and the Parilla Sand (where the confining layer has been eroded). Contamination from Lake Hawthorn, should be low because of the Mildura-Merbein Interception Scheme intercepts the groundwater entering the Murray River. However, if the scheme were not in place leakage from the lake could be high. Narayan and Armstrong (1993), predict water pumped from the bores and back into nearby Lake Ranfurly will be picked up in the interception bores again within 18-20 years.

<Hydraulic linkage to surface runoff> High lake levels may result in salinisation of the floodplain and in the Woorinen dunes.

<Category - hydraulic stability>

<Site Name> Lake Hawthorn
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Bluml, M., 1992- Sunraysia Salinity management Plan Environment report., Dept of Conservation and Environment, ISBN 0 7306 2715 2, 103 p.

Cox, F., 1989- Mildura-Merbein Groundwater Interception Scheme north of Lake Ranfurly redesign of pumping bores., Rural Water Corporation Unpublished report 1989/28

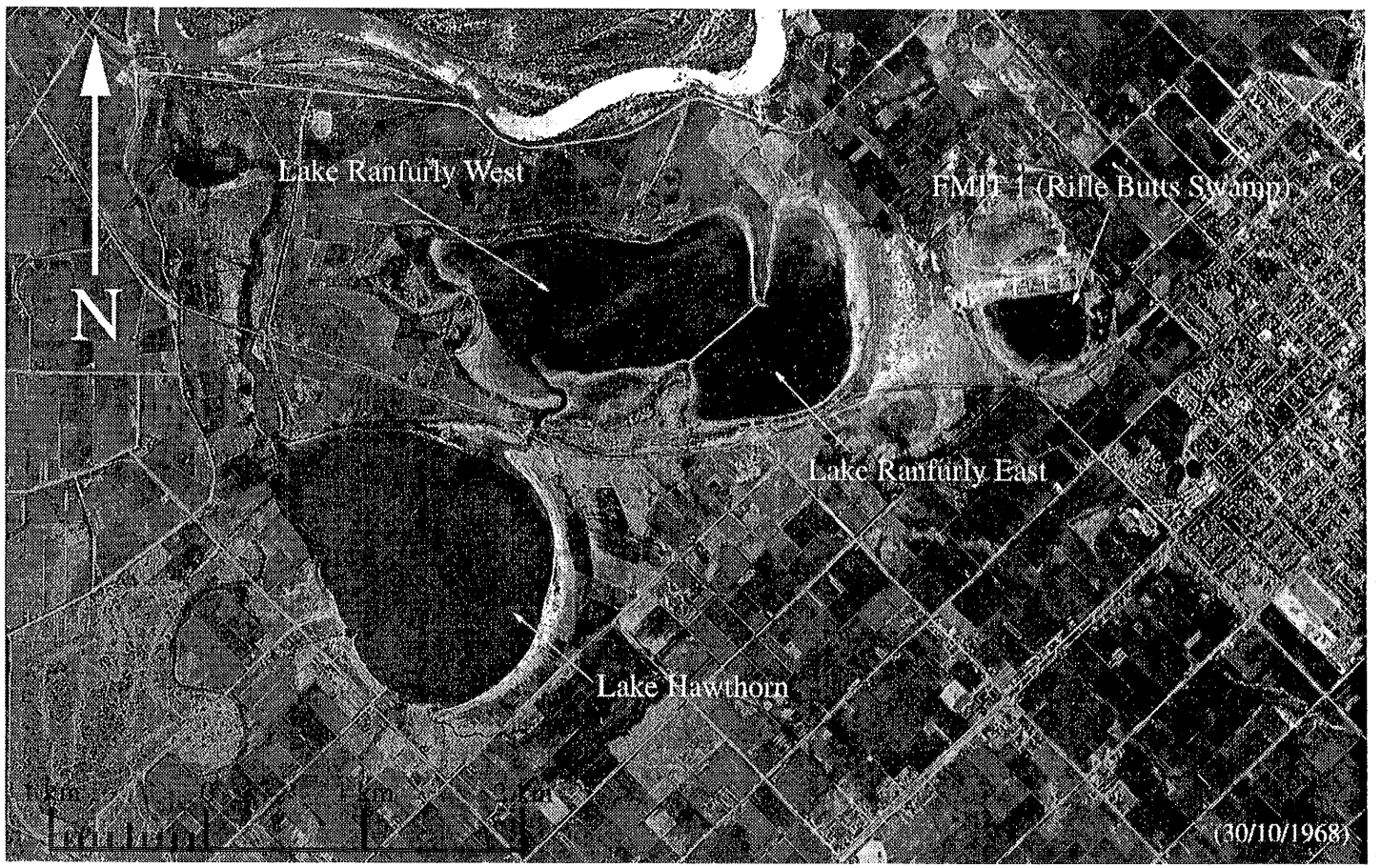
Gato, S. and Budahazy, M., 1992- Sunraysia salinity management plan: Lake Hawthorne scheme: alternate operational criteria., Rural Water Commission of Victoria report no. 1992/10

Narayan, K., and Armstrong, D., 1993- Simulation of groundwater interception at Lake Ranfurly, Victoria, incorporating variable density flow and solute transport., Centre for Groundwater Studies, Report 52

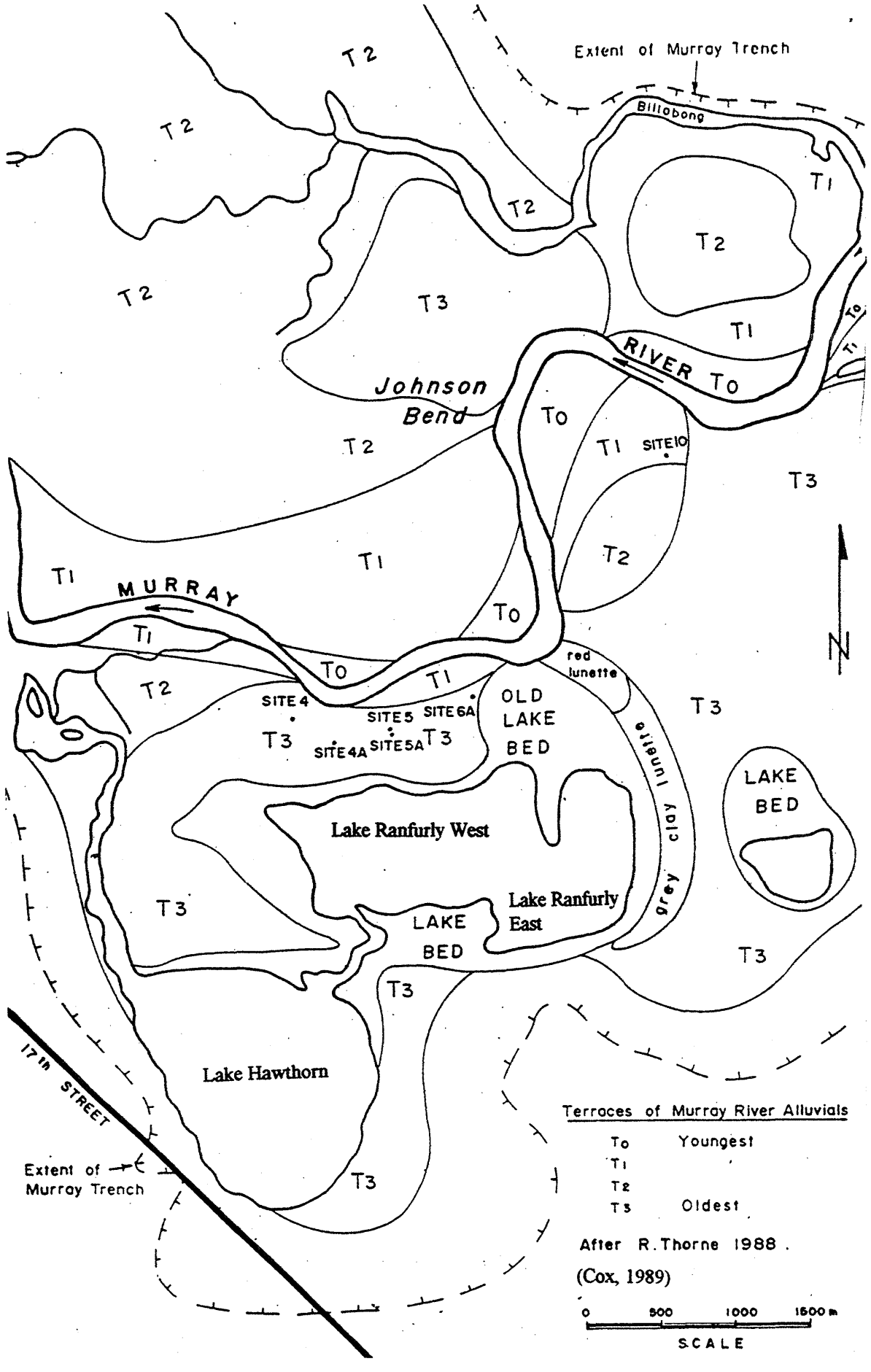
Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

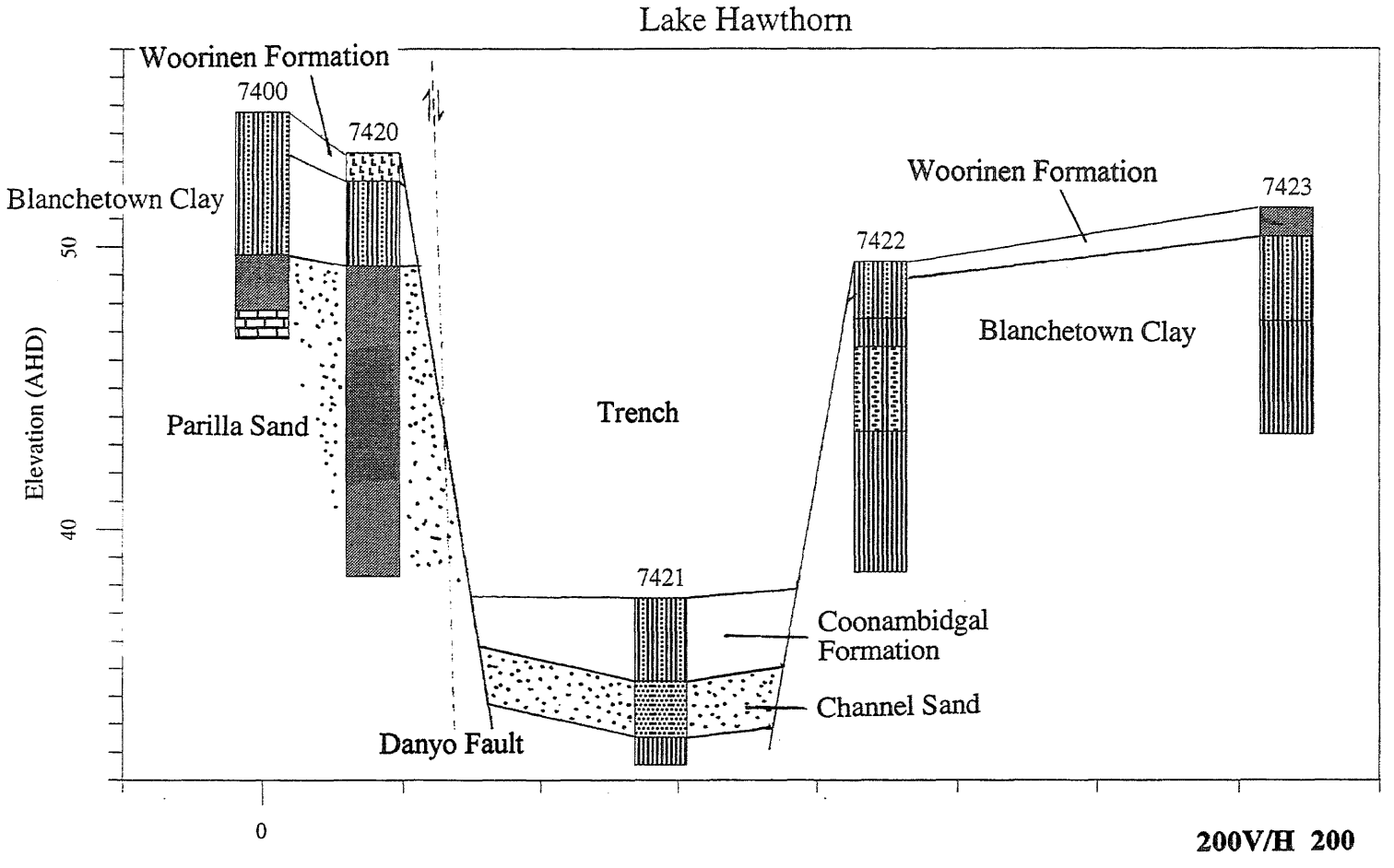
State Rivers and Water Supply Commission, Victoria (SR&WSC), 1974- Sunraysia Salinity Investigations., Unpublished report

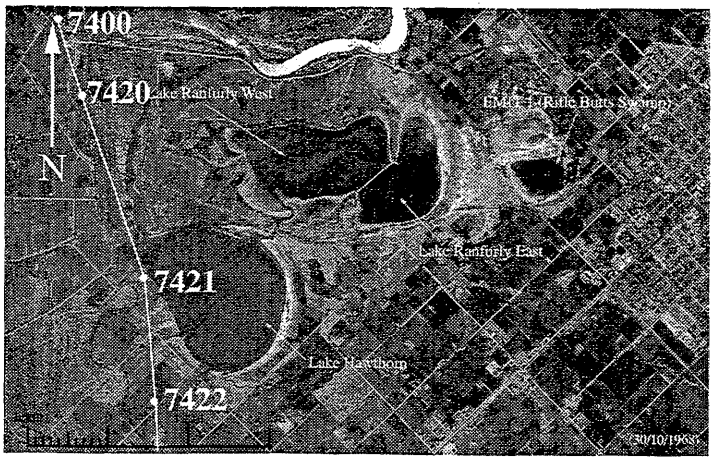
Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
Lake Ranfurly West
FMIT 1 (Rifle Butts Swamp)
Lake Ranfurly East
Lake Hawthorn
1 km
1 km
1 km
(30/10/1968)

Schematic map of Lake Ranfurly East, Lake Ranfurly West, and Lake Hawthorn




Lake Hawthorn
Woorinen Formation
7400
7420
Blanchetown Clay
Elevation (AHD)
50
40
Parilla Sand
Trench
Danyo Fault
7421
Coonambidgal Formation
Channel Sand
Woorinen Formation
7423
7422
Blanchetown Clay
0
200V/H 200


7400
7420
N
7421
7422
Lake Rantonly West
Lake Rantonly East
Lake Hawthorn

<Site Name> Lake Iraak
<Synonyms>

Spatial

<Location description> 1 kilometre NW of Bullock Swamp and 2.5 kilometres WNW of Iraak, Victoria

<Located in Murray Trench> Yes

<Location 1:250 000> Mildura

<Location 1:100 000> Mildura 7329

<Zone> 54

<Coordinates easting (AMG)> 621600

<Coordinates northing (AMG)> 6190600

<State> Victoria

General

<Year begun operation>

<Active/inactive> Active

<Full surface area (ha)> 101 ha

<Volume capacity (ML)>

<Full surface level (m AHD)> ~38.5-39.0 m AHD (RWC map 147160, C. Thompson)

<Groundwater level (m AHD)> Channel Sand: 38.1 m AHD; Parilla Sand: 37 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<Groundwater seepage/discharge> Seepage

<Average annual evaporation> Inflow/evaporation = 0.7; 1980 mm Class A pan Red Cliffs

<Volume disposed annually (ML/yr)> 900 ML

<Salinity of water disposed (EC)> 2000 EC

<Range of salinity in basin (EC)> Dry

<Sources of water to be disposed> Irrigation Drainage Water

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> Lake Iraak
<Synonyms>

Engineering/Admin

<**Public or private operation**> Landholder/private users of public land

<**Agency responsible**> Department of Conservation and Natural Resources

<**Project name**> Lake Iraak Disposal Basin

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Permanently closed to flooding from the Murray River by earthen banks on the original inlet creek.

Geological

<**Site description and Geomorphology**> A circular depression located in the Murray Trench and surrounded by the Rufus Terrace although the basin is floored by the Coonambidgal Formation. It appears the lake was a meander loop of the Murray River but is now completely isolated from the river.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is northwest of the Raak Trough and southeast of the Neckarboo Ridge (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Coonambidgal Formation (3 m), and is underlain by the Channel Sand (6-10 m), the Blanchetown Clay (16-17 m), the Parilla Sand (70 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Coonambidgal Formation

<**Host lithofacies**> Silt and silt clay

<**Aquitard**> Coonambidgal Formation and Blanchetown Clay

<**Aquitard lithofacies**> Coonambidgal Formation: Silt and silty clay; Blanchetown Clay: Clay and clayey silt

<**Aquifer**> Channel Sand and Parilla Sand

<**Aquifer lithofacies**> Channel Sand and Parilla Sand: Medium to coarse quartz sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 2.2 kilometres

<Site Name> Lake Iraak
<Synonyms>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Northeast towards the river (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Coonambidgal Formation: 3 metres; Blanchetown Clay: 16-17 metres

<kv and kh of aquifer> Channel Sand: Kh = 10-40 m/day, Parilla Sand: Kh = 1 m/day (Linke, 1990b)

<EC of aquifer> > 50,000 mg/L TDS (RWC, 1993); Channel Sand: 45,000-50,000 EC, Parilla Sand: 25,000 EC (Thorne, Hoxley, and Chaplin, 1990)

<Porosity of aquifer> 20% (Linke, 1990b)

<Thickness of aquifer> Channel Sand: 6-10 metres; Parilla Sand: 70 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Linke (1993) found that Lake Iraak does not intercept any groundwater from the Channel Sand. Instead, because its full level is higher than the potentiometric level within the Channel Sand there is the capacity for the basin to leak. Counteracting the leakage potential is the evaporation surplus of the basin (2200 ML evaporation and 900 ML input), which keeps the basin dry and the low permeability of the Coonambidgal Formation, which acts as an aquitard. However, problems may occur if the Coonambidgal Formation dries out completely forming mudcracks, which may allow the disposal water and salt washed in by the rain direct access to the Channel Sand. The groundwater in the Channel Sand flows towards and is in hydraulic contact with the River Murray allowing potential saline contamination of the river.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> Lake Iraak
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus> The evaporation potential is 2200 ML/yr (1980 mm/yr x 110 ha) and the input is 900 ML/yr, leaving a surplus of 1300 ML/y.

Interpretive 2

<Ranking of sustainability>

References Cited

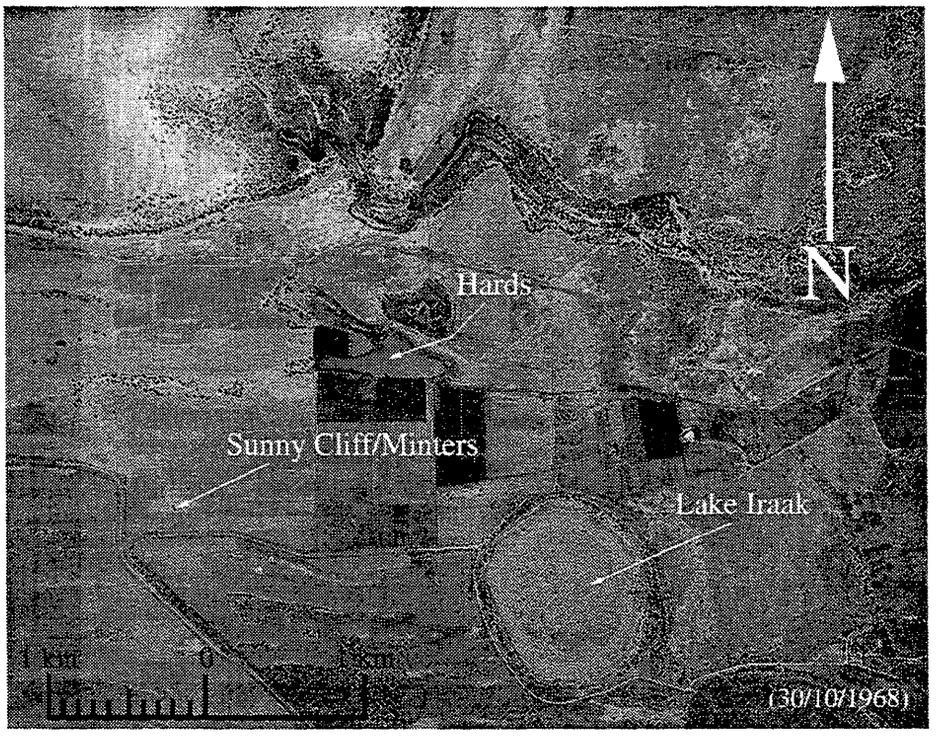
Barling. R., and Linke, G., 1993- Nangiloc Colignan Salinity Management Plan Technical note on lake Iraak and Doerings Basin., Rural Water Corporation, Unpublished technical note

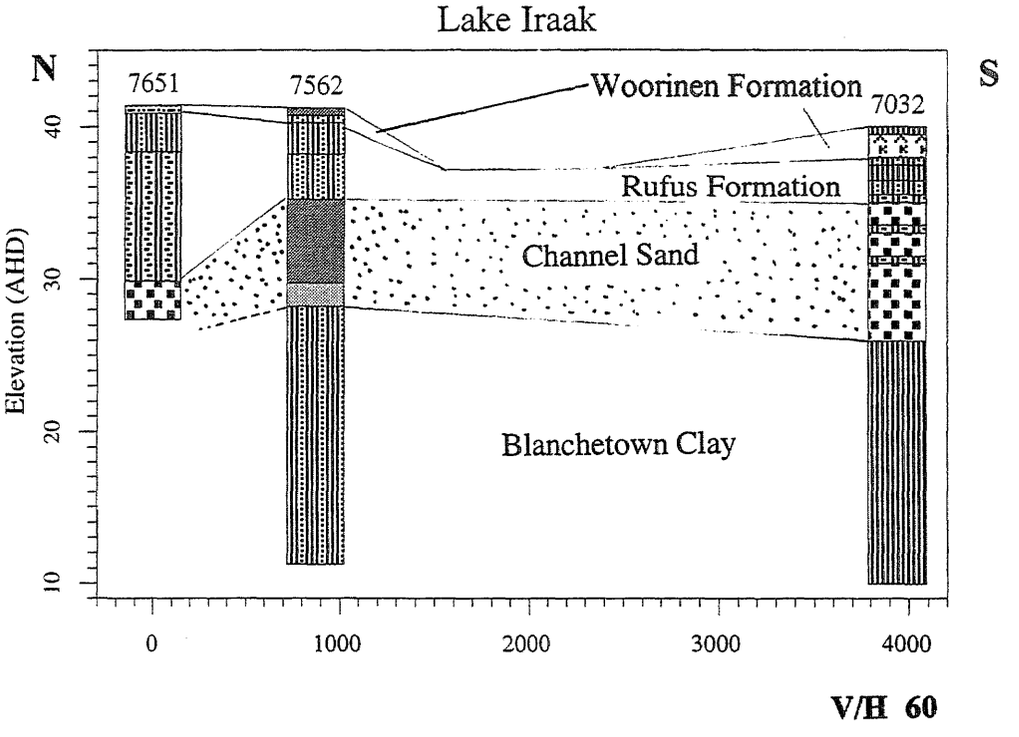
Linke, G., 1993- Nangiloc Colignan SMP - Drainage disposal to Karadoc Swamp - CMS Comps., Rural Water Corporation, Unpublished working file No. 93/01895

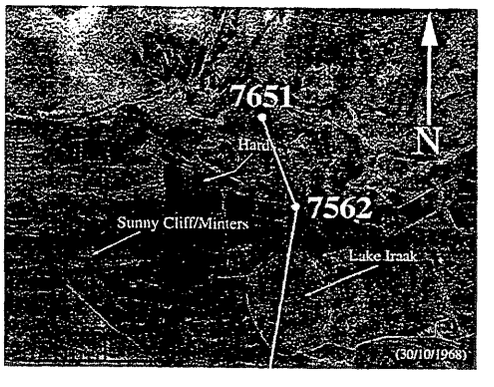
Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
Hards
Sunny Cliff/Minters
Lake Iraak
1 km
0
1 km
(30/10/1968)


Lake Iraak
N
S
7651
7562
7032
Woorinen Formation
Rufus Formation
Channel Sand
Blanchetown Clay
Elevation (AHD)
10
20
30
40
0
1000
2000
3000
4000
V/H 60


7651
N
Hard
7562
Sunny Cliff/Minters
Lake Iraak
(30/10/1968)

<Site Name> Lake Kelly
<Synonyms>

Spatial

<Location description>

<Located in Murray Trench> No

<Location 1:250 000> Swan Hill

<Location 1:100 000> Kerang 7626

<Zone> 54

<Coordinates easting (AMG)> 754900

<Coordinates northing (AMG)> 6062700

<State> Victoria

General

<Year begun operation> 1972

<Active/inactive> Active

<Full surface area (ha)> 201 ha

<Volume capacity (ML)> 2260 ML

<Full surface level (m AHD)> 70.87 m AHD

<Groundwater level (m AHD)> 71.5 m AHD (O'Rourke, 1992)

<Groundwater seepage/discharge> Seepage and discharge

<Average annual evaporation> Inflow/evaporation = 0.7

<Volume disposed annually (ML/yr)> 11,000 ML/yr (all basins)

<Salinity of water disposed (EC)> 7000 EC

<Range of salinity in basin (EC)> 18,000-206,000 EC

<Sources of water to be disposed> Barr Creek

<Terminal/throughflow basin> Throughflow

<Range of elevation of lake surface with disposal> Mean depth 1.1 metre

<Lining/treatment of base> None

<Review of environmental impacts>

Engineering/Admin

<Public or private operation> Public

<Site Name> Lake Kelly
<Synonyms>

<Agency responsible> Rural Water Corporation

<Project name> Barr Creek Interception Scheme

<Natural, modified natural or constructed> Natural

<Modification type and degree> None

Geological

<Site description and Geomorphology> The lake is located within a deflation basin that is roughly oval in shape and trends NE-SW. It is bounded on the east by a lunette. The size of the lake varies with the amount of disposal and the connection to Lake Little.

<Subsurface investigations at site>

<Structural setting> The basin is located in the Kerang Lakes Trough and east of the Leaghur Fault (Pratt, 1988).

<Stratigraphic setting> The basin is floored by the Yamba Formation (1-3 m), and is underlain by the Shepparton Formation (40-50 m), the Parilla Sand (50-60 m), the Upper Renmark Group (Boga Silt 30 m) and the Renmark Group (120 metres) including up to 30 metres of coal (Barnewall and Brinkley, 1992).

<Host formation> Yamba Formation

<Host lithofacies> Clay salt and lunette deposits

<Aquitard> Shepparton Formation

<Aquitard lithofacies> Continuous layer of light brown sandy clay with minor occurrence of sand lenses.

<Aquifer> Parilla Sands and Shepparton Formation (in sandy lenses); Renmark Group

<Aquifer lithofacies> Parilla Sand: Fine to medium sand; Shepparton Formation: Isolated sand bodies consisting of fine to medium sand; Renmark Group: consists of quartz sands, gravels, ligneous clays and silts, with coal layers up to 30 metres thick. The upper section (Boga Silt), is a grey-green to olive-green clay and silt with associated black carbonaceous clay and silt and minor very fine to medium grained sand (Barnewall and Brinkley, 1992).

<Comments> Data is shared among Lake Little, Lake Kelly, Lake William, and Lake Tutchewop.

Summary of Hydrodynamics

<Distance to Murray or tributary> 5 kilometres

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Northeast controlled by geometry of the Parilla Sands (Dimos, 1992). In the Shepparton flow is to the northwest (Barnewall and Brinkley, 1992)

<kv of artificial floor>

<Site Name> Lake Kelly
<Synonyms>

<kv and kh of host>

<kv and kh of aquitard> Shepparton Formation: Kv = 10^{-2} m/day; Kh = 10^{-1} to 10^{-2} m/day (Harrison, in prep)

<Thickness of aquitard> Shepparton Formation: 50-60 metres

<kv and kh of aquifer> Parilla Sand: Kh = 2 m/day (O'Rourke, 1992)

<EC of aquifer> Renmark Group (40,000-50,000 mg/L TDS); Parilla Sand (14,500-54,000 mg/L TDS); Shepparton Formation (19,500-42,000 mg/L TDS) (Barnewall and Brinkley, 1992).

<Porosity of aquifer>

<Thickness of aquifer> Renmark Group: 130 metes; Parilla Sand: 50-60 metres; Shepparton Formation: Variable depending on presence or absence of sand bodies

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The salinity of Lake Kelly ranges from 18,000 to 206,000 EC and has a brine beneath the surface of about 100,000 mg/L. It also receives highly saline discharge (>100,000 mg/L). The salinity of the Shepparton Formation is 19,900-42,000 mg/L TDS, the Parilla Sand is 40,000-50,000 mg/L TDS, and the Renmark Group is 14,500-54,000 mg/L TDS (Ferguson, 1993; Barnewall and Brinkley, 1992). The Renmark Group is under pressure due to partial the confinement of the Boga Silt and discharges into the Parilla Sand, while the pressure in the Parilla Sand is above the ground surface of the basin due to confinement by the Shepparton Formation. However, the situation is much more complex. As the groundwater levels change with the seasons and in some place the Shepparton Formation actually discharges into the Parilla Sand and the Renmark Group (Harrison, in prep).

The source of discharge into and/or around Lake Kelly is unknown. The salinity of the discharge water is much higher than the Parilla Sand, also the Parilla would have to travel through 40-50 metres of low permeability clay to enter the basin, which would necessitate some fracture enhanced porosity. Water from the Shepparton Formation is also much less saline than the discharge, however because of the long history of the area as the terminus of the Kerang Lakes System, hypersaline water may be stored in the Shepparton Formation from two previous lake stages (within the clay and silt or the sand lenses). The water may be being mobilised due to irrigation activity and/or pressure from the Parilla Sand. Another possibility is that the discharge comes from the lake itself due to higher than normal levels (Harrison, in prep), although salinity profiling suggests a more complex suggests behaviour (Ferguson, 1993).

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

<Site Name> Lake Kelly
<Synonyms>

Interpretive 2

<Ranking of sustainability>

References Cited

Barnewall, K., and Brinkley, A., 1992- Lake Tutchewop Disposal Complex hydrogeological and groundwater monitoring review, Unpublished report number 1992/ , Rural Water Commission, 14 pp.

Caldwell Connell Engineers Pty. Ltd., 1984- Salt harvesting at the mineral reserve basins, Unpublished report, State Rivers and Water Supply Commission of Victoria, 18 pp.

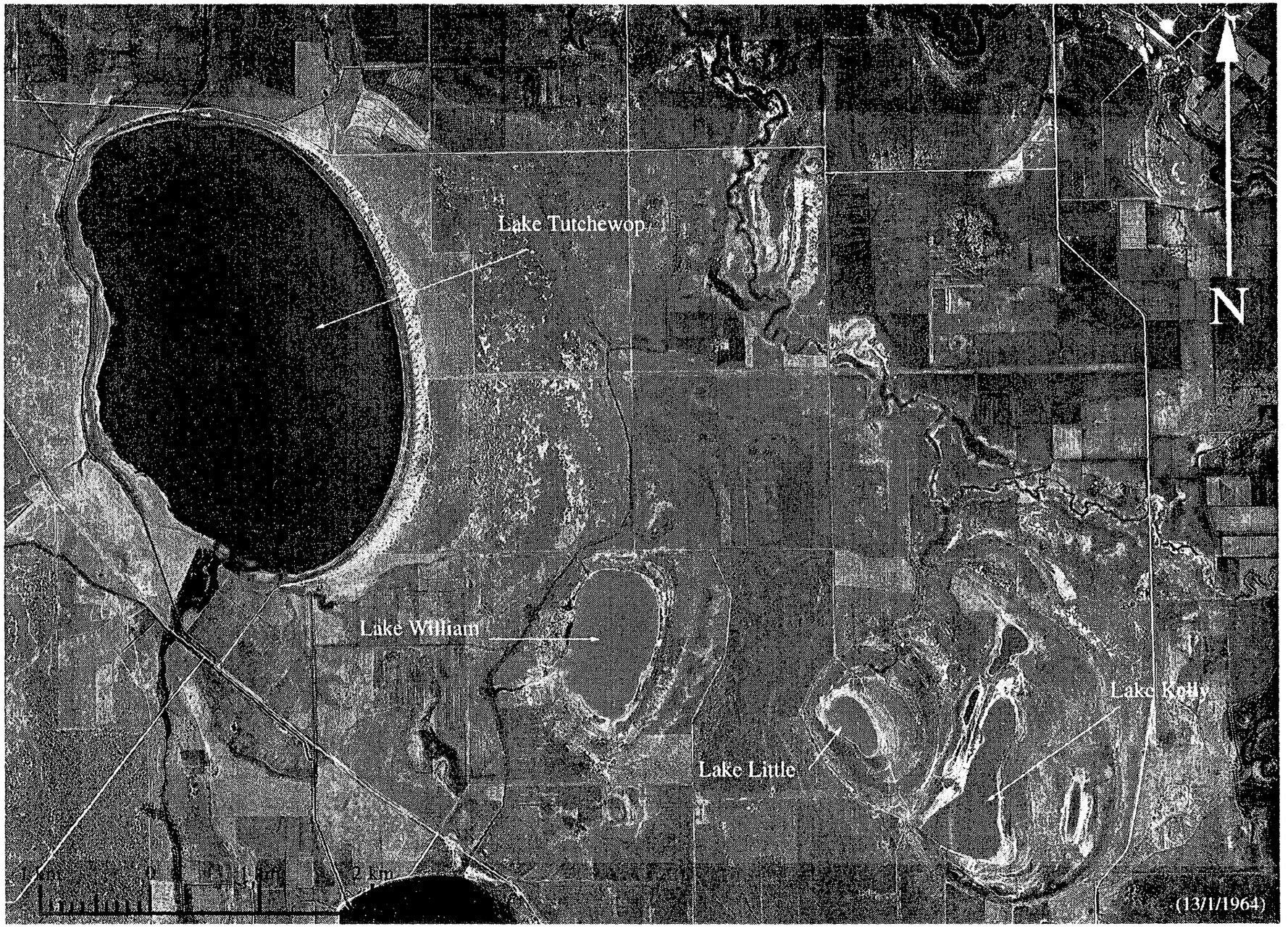
Dimos, Alexandra, 1992- Lake Tutchewop investigation of possible salinisation to neighbouring region by Lake Tutchewop, Rural Water Corporation, Technical Services, Technical Report No. 1992/TN/71/92, 68 pp.

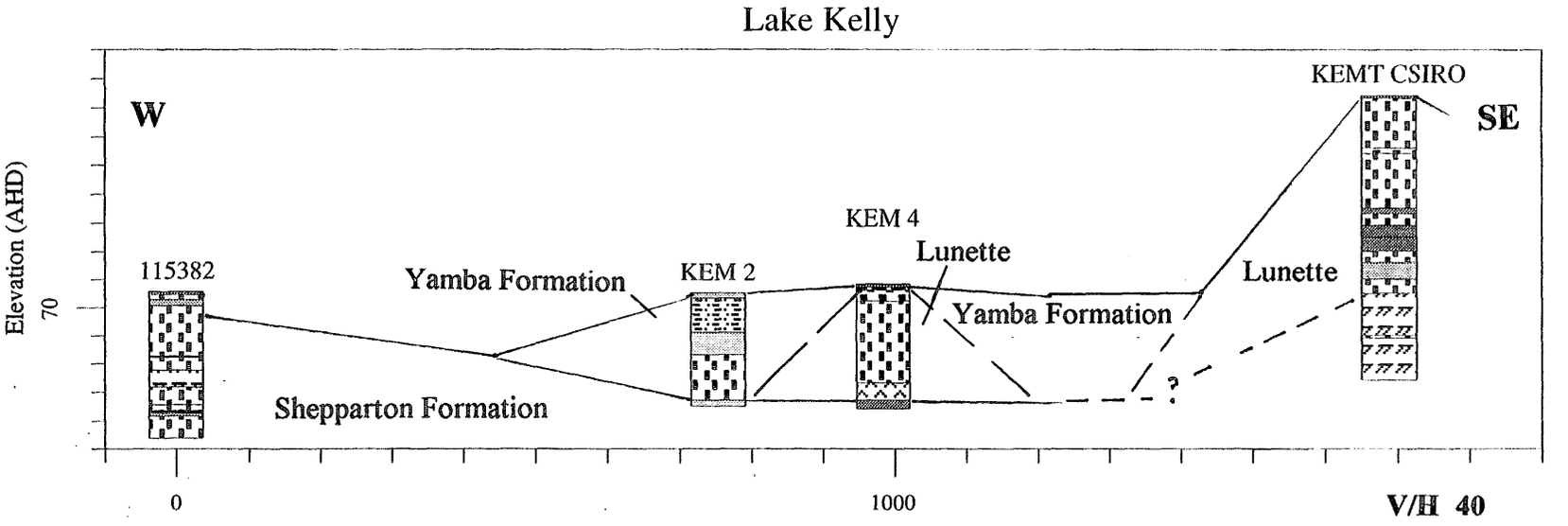
Ferguson, J., 1993- Hydrodynamics of the Lake Tutchewop salt disposal complex, Murray Basin, Preliminary Report on AGSO Investigations, 6 pp.

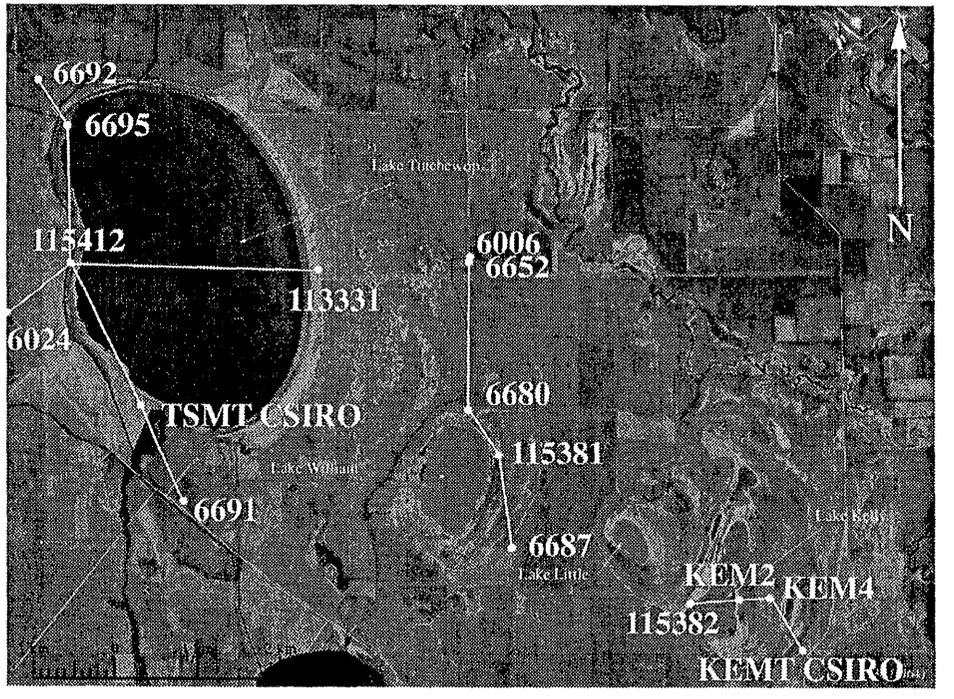
Harrison, A., in prep- Lake Tutchewop hydrogeological investigation., Rural Water Corporation (Hydrotechnology), Unpublished report

Hoxley, G., Ife, D., and Pratt, M., 1989- Kerang Lakes Area hydrogeological assessment., Rural Water Corporation, Draft report

O'Rourke, M.E., et. al, Victorian Rural Water Commission, 1992- Swan Hill Hydrogeological Map (1:250,000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra Australia


Lake Tutchewop
N
Lake William
Lake Kelly
Lake Little
2 Km
(13/1/1964)


Lake Kelly
W
SE
KEMT CSIRO
Elevation (AHD)
70
115382
Yamba Formation
KEM 2
KEM 4
Lunette
Yamba Formation
Lunette
Shepparton Formation
?
0
1000
V/H 40


6692
6695
115412
113331
6024
TSMT CSIRO
6691
6006
6652
6680
115381
6687
Lake Little
KEM2
KEM4
115382
KEMT CSIRO
N

<Site Name> Lake Little
<Synonyms>

Spatial

<Location description> 8 kilometres ENE of Mystic Park, Victoria and 23 kilometres NNW of Kerang, Victoria

<Located in Murray Trench> Yes

<Location 1:250 000> Swan Hill

<Location 1:100 000> Kerang 7626

<Zone> 54

<Coordinates easting (AMG)> 754900

<Coordinates northing (AMG)> 6062700

<State> Victoria

General

<Year begun operation> 1972

<Active/inactive> Active

<Full surface area (ha)> 201 ha

<Volume capacity (ML)> 2260 ML

<Full surface level (m AHD)> 70.87 m AHD

<Groundwater level (m AHD)> ~71.5 m AHD (O'Rourke, 1992)

<Groundwater seepage/discharge> Seepage and discharge

<Average annual evaporation> Inflow/evaporation = 0.7

<Volume disposed annually (ML/yr)> 11,000 ML/yr (all basins)

<Salinity of water disposed (EC)> 7000 EC

<Range of salinity in basin (EC)> 18,000-206,000 EC

<Sources of water to be disposed> Barr Creek Interception Scheme

<Terminal/throughflow basin> Throughflow

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> Lake Little
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Barr Creek Interception Scheme

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The lake is located within a deflation basin that is roughly oval in shape, and trends NW-SE. It is bounded on the east by a lunette and is variable in size depending on the amount of disposal.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located in the Kerang Lakes Trough and east of the Leaghur Fault (Pratt, 1988).

<**Stratigraphic setting**> The basin is floored by the Yamba Formation (1-3 m), and is underlain by the Shepparton Formation (40-50 m), the Parilla Sand (50-60 m), the Upper Renmark Group (Boga Silt 30 m) and the Renmark Group (120 metres) including up to 30 metres of coal (Barnewall and Brinkley, 1992).

<**Host formation**> Yamba Formation

<**Host lithofacies**> Clay salt and lunette deposits

<**Aquitard**> Shepparton Formation

<**Aquitard lithofacies**> Continuous layer of light brown sandy clay with minor occurrence of sand lenses.

<**Aquifer**> Parilla Sands and Shepparton Formation (in sandy lenses); Renmark Group

<**Aquifer lithofacies**> Parilla Sand: Fine to medium sand; Shepparton Formation: Isolated sand bodies consisting of fine to medium sand; Renmark Group: consists of quartz sands, gravels, ligneous clays and silts, with coal layers up to 30 metres thick. The upper section (Boga Silt), is a grey-green to olive-green clay and silt with associated black carbonaceous clay and silt and minor very fine to medium grained sand (Barnewall and Brinkley, 1992).

<**Comments**> Data is shared among Lake Little, Lake Kelly, Lake William, and Lake Tutchewop.

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 5 kilometres

<**Head between basin and river/tributary**>

<Site Name> Lake Little
<Synonyms>

<Direction of groundwater flow in regional aquifer> Northeast controlled by geometry of the Parilla Sands (Dimos, 1992). In the Shepparton flow is to the northwest (Barnewall and Brinkley, 1992)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard> Shepparton Formation: Kv = ~10^{-2} m/day; Kh = ~10^{-1} to 10^{-2} m/day (Harrison, in prep)

<Thickness of aquitard> Shepparton Formation: 50-60 metres

<kv and kh of aquifer> Parilla Sand: Kh = 2 m/day (O'Rourke, 1992)

<EC of aquifer> Renmark Group (40,000-50,000 mg/L TDS); Parilla Sand (14,500-54,000 mg/L TDS); Shepparton Formation (19,500-42,000 mg/L TDS) (Barnewall and Brinkley, 1992).

<Porosity of aquifer>

<Thickness of aquifer> Renmark Group: 130 metes; Parilla Sand: 50-60 metres; Shepparton Formation: Variable depending on presence or absence of sand bodies

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The salinity of Lake Little ranges from 18,000 to 206,000 EC and has a brine beneath the surface of about 100,000 mg/L. It also receives highly saline discharge (>100,000 mg/L). The salinity of the Shepparton Formation is 19,900-42,000 mg/L TDS, the Parilla Sand is 40,000-50,000 mg/L TDS, and the Renmark Group is 14,500-54,000 mg/L TDS (Ferguson, 1993; Barnewall and Brinkley, 1992). The Renmark Group is under pressure due to partial confinement by the Boga Silt and discharges into the Parilla Sand. The pressure in the Parilla Sand is above the ground surface of the basin due to confinement by the Shepparton Formation. However, the situation is much more complex as the groundwater levels change with the seasons and in some place the Shepparton Formation actually discharges into the Parilla Sand and the Renmark Group (Harrison, in prep). The source of discharge into and/or around Lake Little is unknown.

Water from the Shepparton Formation is much less saline than the discharge, however because of the long history of the area as the terminus of the Kerang Lakes System, hypersaline water may be stored in the Shepparton Formation from two previous lake stages (within the clay and silt or the sand lenses). The water may be being mobilised due to irrigation activity and/or pressure from the Parilla Sand. Another possibility is that the discharge comes from the lake itself due to higher than normal levels (Harrison, in prep), although salinity profiling suggests a more complex suggests behaviour (Ferguson, 1993).

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Site Name> Lake Little
<Synonyms>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Barnewall, K., and Brinkley, A., 1992- Lake Tutchewop Disposal Complex hydrogeological and groundwater monitoring review, Unpublished report number 1992/ , Rural Water Commission, 14 pp.

Caldwell Connell Engineers Pty. Ltd., 1984- Salt harvesting at the mineral reserve basins, Unpublished report, State Rivers and Water Supply Commission of Victoria, 18 pp.

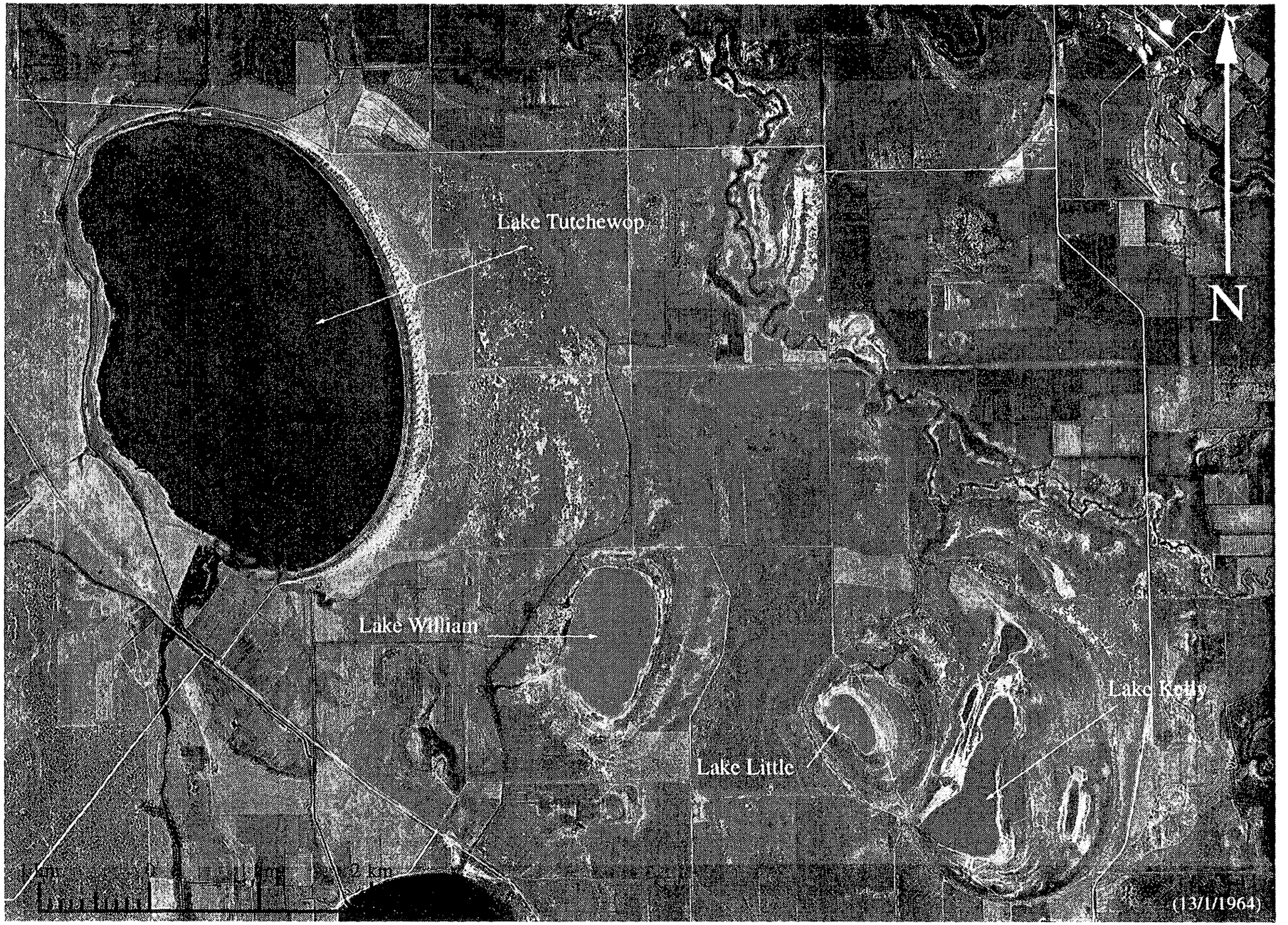
Dimos, Alexandra, 1992- Lake Tutchewop investigation of possible salinisation to neighbouring region by Lake Tutchewop, Rural Water Corporation, Technical Services, Technical Report No. 1992/TN/71/92, 68 pp.

Ferguson, J., 1993- Hydrodynamics of the Lake Tutchewop salt disposal complex, Murray Basin, Preliminary Report on AGSO Investigations, 6 pp.

Harrison, A., in prep- Lake Tutchewop hydrogeological investigation., Rural Water Corporation (Hydrotechnology), Unpublished report

Hoxley, G., Ife, D., and Pratt, M., 1989- Kerang Lakes Area hydrogeological assessment., Rural Water Corporation, Draft report

O'Rourke, M.E., et. al, Victorian Rural Water Commission, 1992- Swan Hill Hydrogeological Map (1:250,000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra Australia


Lake Tutchewop
Lake William
Lake Little
Lake Kelly
N
1 km
2 km
(13/1/1964)

<Site Name> Lake Ranfurly East
<Synonyms>

Spatial

<Location description> 2.5 kilometres west of Mildura, Victoria, and 5 kilometres ESE of Merbein, Victoria

<Located in Murray Trench> Yes

<Location 1:250 000> Mildura

<Location 1:100 000> Mildura 7329

<Zone> 54

<Coordinates easting (AMG)> 603200

<Coordinates northing (AMG)> 6216200

<State> Victoria

General

<Year begun operation> 1980

<Active/inactive> Active

<Full surface area (ha)> 81 ha

<Volume capacity (ML)> 482 ML

<Full surface level (m AHD)> 34.5 m AHD

<Groundwater level (m AHD)> 36 m AHD

<Groundwater seepage/discharge> Discharge

<Average annual evaporation> Inflow/evaporation > 1.5

<Volume disposed annually (ML/yr)> 3654 ML/yr

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)> 16,660-84,000 EC

<Sources of water to be disposed> Mildura Merbein groundwater interception

<Terminal/throughflow basin> Throughflow

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> Lake Ranfurly East
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Commission (Mildura Merbein Groundwater Interception)

<**Project name**> Lake Ranfurly East

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Banks have been built

Geological

<**Site description and Geomorphology**> The basin is located in the Murray Trench on the Rufus Terrace approximately 7 metres above the river. The basin is bounded on the east by a large lunette and on the west by a retaining wall which separates it from Lake Ranfurly West. Lake Ranfurly was formerly connected to Lake Hawthorn and the River Murray, but is now isolated.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located in the Koorlong Trough south east of the Danyo Fault (Thorn, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Yamba Formation (1-2 m), and is underlain by the Rufus Formation (3-5 m), the Channel Sand (4 m), the Parilla Sand (20-30 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin in addition to RWC bores, and Cox, 1989).

<**Host formation**> Yamba Formation and Rufus Formation

<**Host lithofacies**> Yamba Formation: lunette; Rufus Formation: Clays and silts

<**Aquitard**> Rufus Formation and Upper Parilla Sand

<**Aquitard lithofacies**> Rufus Formation: Silts and clays; Upper Parilla Sand: Pisolitic ferruginous duricrust (Cox, 1989)

<**Aquifer**> Channel Sand and Parilla Sand

<**Aquifer lithofacies**> Parilla Sand: Fine to coarse sand; Channel Sand: Coarse to medium sand, typically 50% coarse, 36% medium, and 8-10 % fine sand, silt and clay (Cox, 1989)

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 500 metres

<**Head between basin and river/tributary**> 7 metres

<Site Name> Lake Ranfurly East
<Synonyms>

<Direction of groundwater flow in regional aquifer> Northwest to the river (RWC, 1991)

<kv of artificial floor>

<kv and kh of host> Rufus Formation: Kv = 5 x 10^{-8} to 5 x 10^{-6} m/day; Kh = 0 m/day (Narayan and Armstrong, 1993)

<kv and kh of aquitard> Rufus Formation: Kv = 5 x 10^{-8} to 5 x 10^{-6} m/day; Kh = 0 m/day (Narayan and Armstrong, 1993)

<Thickness of aquitard> Rufus Formation: 3-6 metres; Upper Parilla Sand: 2-4 metres

<kv and kh of aquifer> Parilla Sand: Kh = 5 m/day (Narayan and Armstrong, 1993)

<EC of aquifer> >50,000 mg/L TDS; Channel Sand: 3,000-40,000 EC; Parilla Sand: <60,000 EC; Groundwater at Lake Ranfurly: 140,000 EC (Cox, 1989)

<Porosity of aquifer> 0.30 (Narayan and Armstrong, 1993)

<Thickness of aquifer> Channel Sand: 4 metres; Parilla Sand: 30 metres

<kv and kh of alluvial aquifer> Channel Sand: 25 m/day (Narayan and Armstrong, 1993)

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Water leaks from Lake Ranfurly through the Rufus Formation and into the Channel Sand at a rate of 360 ML/year (Cox, 1989). The water is intercepted before it reaches the River Murray by a line of interception bores which are part of the Mildura-Merbein Groundwater Interception Scheme and the water is disposed back into the lake. In addition, because of the irrigation mound above the trench Lake Ranfurly receives groundwater discharge from either the Parilla Sand or the Irymple Member of the Blanchetown Clay. Modelling of the lake by Narayan and Armstrong (1993), suggest that first the salt is concentrated in the lake due to evaporation, it then penetrates the Rufus Formation and enters the Channel Sand where it flows towards the river, where it is picked up by the interception bores and returned to the lake, in a cycle taking about 18 to 20 years. Problems of contamination could arise due to windows in the Upper Parilla Aquitard where the Channel Sand and Parilla Sand are in contact which would allow the highly saline water to enter the regional aquifer. Otherwise the groundwater is stopped by the interception scheme.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> Lake Ranfurly East
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Bluml, M., 1992- Sunraysia Salinity management Plan Environment report., Dept of Conservation and Environment, ISBN 0 7306 2715 2, 103 p.

Cox, F., 1989- Mildura-Merbein Groundwater Interception Scheme north of Lake Ranfurly redesign of pumping bores., Rural Water Corporation Unpublished report 1989/28

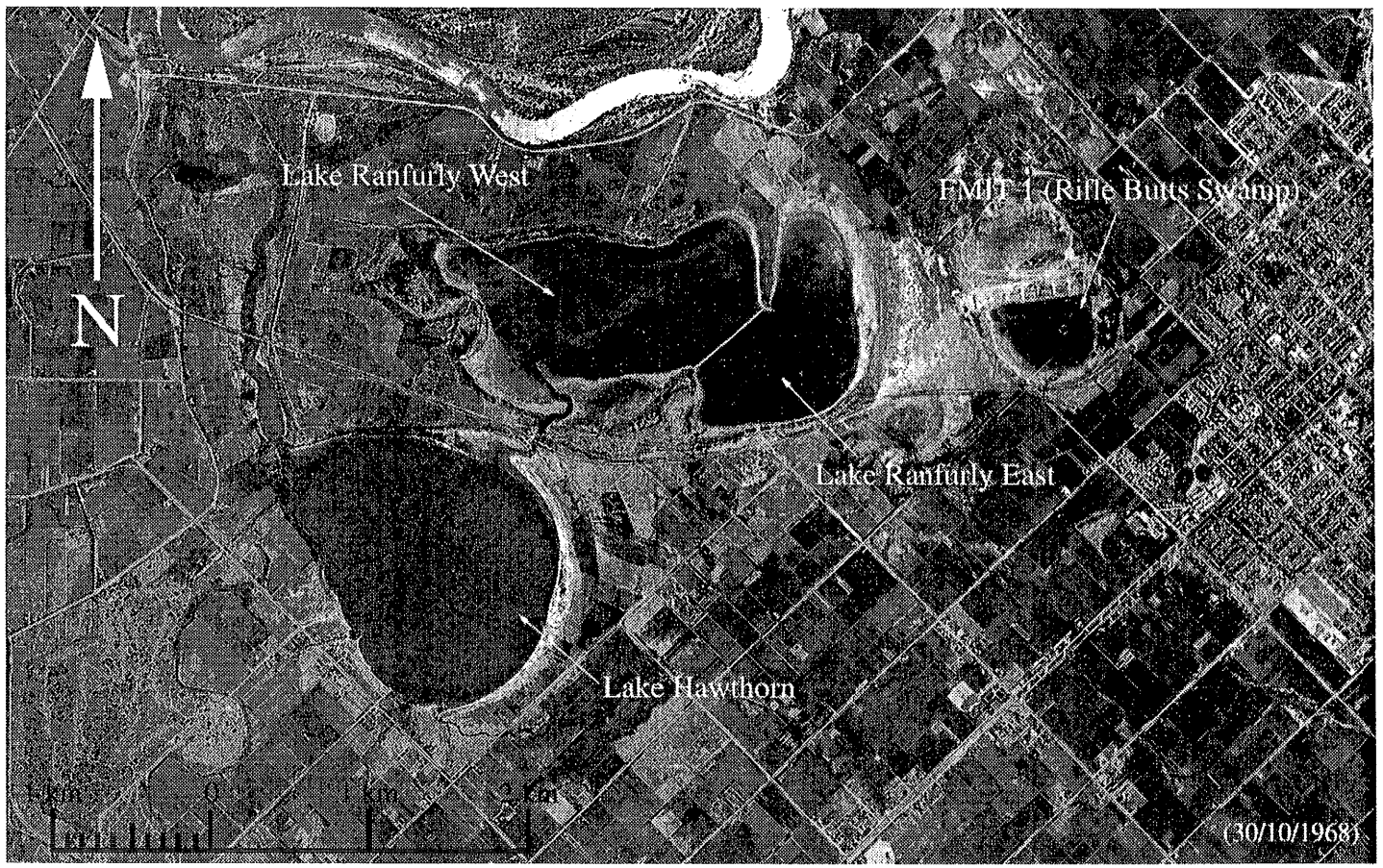
Gato, S. and Budahazy, M., 1992- Sunraysia salinity management plan: Lake Hawthorne scheme: alternate operational criteria., Rural Water Commission of Victoria report no. 1992/10

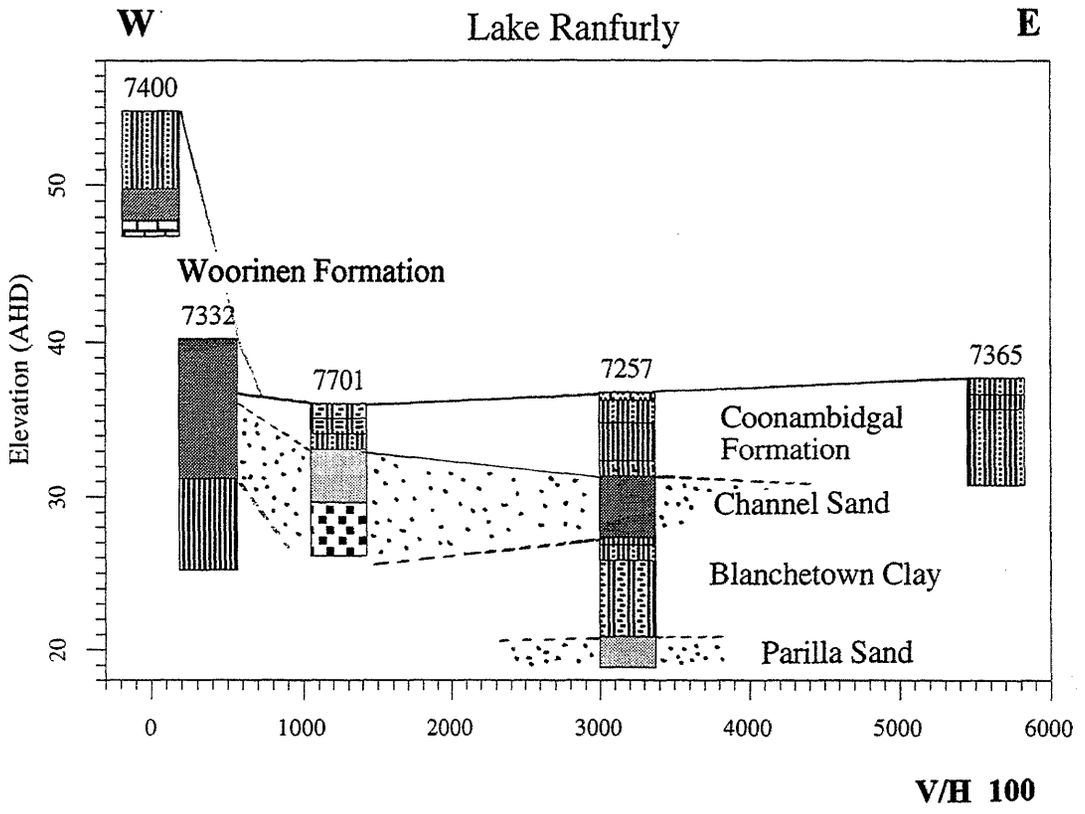
Narayan, K., and Armstrong, D., 1993- Simulation of groundwater interception at Lake Ranfurly, Victoria, incorporating variable density flow and solute transport., Centre for Groundwater Studies, Report 52

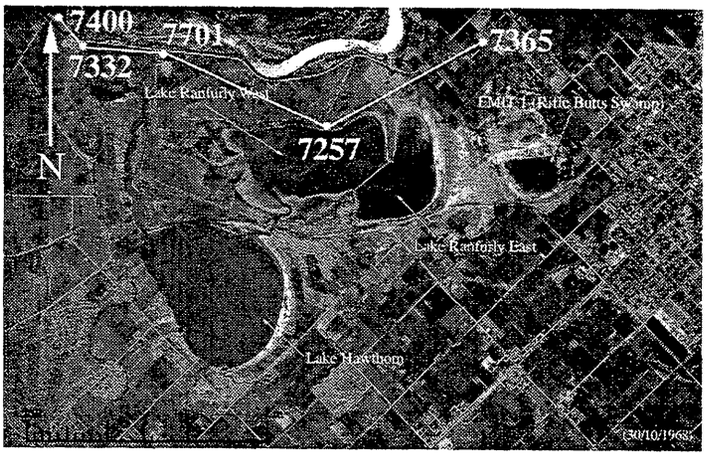
Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

State Rivers and Water Supply Commission, Victoria (SR&WSC), 1974- Sunraysia Salinity Investigations., Unpublished report

R9500408


N
Lake Ranfurly West
FMJT 4 (Rifle Butts Swamp)
Lake Ranfurly East
Lake Hawthorn
1 km
0
1 km
2 km
(30/10/1968)


W
Lake Ranfurly
E
7400
Woorinen Formation
7332
7701
7257
7365
Coonambidgal Formation
Channel Sand
Blanchetown Clay
Parilla Sand
Elevation (AHD)
50
40
30
20
0
1000
2000
3000
4000
5000
6000
V/H 100


7400
7701
7365
7332
Lake Ranfurly West
EMIT 1 (Rifle Butts Swamp)
7257
N
Lake Ranfurly East
Lake Hawthorn
(30/10/1968)

<Site Name> Lake Ranfurly West
<Synonyms>

Spatial

<**Location description**> 3 kilometres ESE of Merbein, Victoria and 4 kilometres west of Mildura, Victoria

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 602300

<**Coordinates northing (AMG)**> 6216400

<**State**> Victoria

General

<**Year begun operation**> 1980

<**Active/inactive**> Active

<**Full surface area (ha)**> 219 ha

<**Volume capacity (ML)**> 707 ML

<**Full surface level (m AHD)**> 34.5 m AHD

<**Groundwater level (m AHD)**> 36 m AHD

<**Groundwater seepage/discharge**> Discharge

<**Average annual evaporation**> Inflow/evaporation > 1.5

<**Volume disposed annually (ML/yr)**> 4800 ML/yr

<**Salinity of water disposed (EC)**> 44,162 EC

<**Range of salinity in basin (EC)**> 50,008-116134 EC

<**Sources of water to be disposed**> Mildura Merbein Groundwater Interception Scheme

<**Terminal/throughflow basin**> Throughflow

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**> High levels of sulphates and carbon dioxide. Water corrosive.

<Site Name> Lake Ranfurly West
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Commission (Mildura Merbein Groundwater Interception Scheme)

<**Project name**> Lake Ranfurly West

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> Banks have been built

Geological

<**Site description and Geomorphology**> The basin is located in the Murray Trench on the Rufus Terrace approximately 7 metres above the river. The basin is bounded on the east by a retaining wall that separates it from Lake Ranfurly East Lake Ranfurly was formerly connected to Lake Hawthorn and the River Murray, but is now isolated.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located in the Koorlong Trough southeast of the Danyo Fault (Thorn, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Yamba Formation (1-2 m), and is underlain by the *Rufus Formation (3-5 m)*, the Channel Sand (4 m), the Parilla Sand (20-30 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin in addition to RWC bores, and Cox, 1989).

<**Host formation**> Rufus Formation

<**Host lithofacies**> Clays and silts

<**Aquitard**> Rufus Formation and Upper Parilla Sand

<**Aquitard lithofacies**> Rufus Formation: silts and clays; Upper Parilla Sand: Pisolitic, ferruginous, duricrust and/or clay (Cox, 1989)

<**Aquifer**> Channel Sand and Parilla Sand

<**Aquifer lithofacies**> Parilla Sand: Fine to coarse sand; Channel Sand: Coarse to medium sand, typically 50% coarse, 36% medium, and 8-10 % fine sand, silt and clay (Cox, 1989)

<**Comments**>

<Site Name> Lake Ranfurly West
<Synonyms>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> <500 metres

<**Head between basin and river/tributary**> 7 metres

<**Direction of groundwater flow in regional aquifer**> North to northeast towards the river (RWC, 1991)

<**kv of artificial floor**>

<**kv and kh of host**> Rufus Formation: Kv 5 x 10^{-8} to 5 x 10^{-6} m/day; Kh 0 m/day (Narayan and Armstrong, 1993)

<**kv and kh of aquitard**> Rufus Formation: Kv 5 x 10^{-8} to 5 x 10^{-6} m/day; Kh 0 m/day (Narayan and Armstrong, 1993)

<**Thickness of aquitard**> Rufus Formation: 3-6 metres; Upper Parilla Sand: 2-4 metres

<**kv and kh of aquifer**> Parilla Sand: Kh 5 m/day (Narayan and Armstrong, 1993)

<**EC of aquifer**> >50,000 mg/L TDS; Channel Sand: 3,000-40,000 EC; Parilla Sand: <60,000 EC; Groundwater at Lake Ranfurly: 140,000 EC (Cox, 1989)

<**Porosity of aquifer**> 0.30 (Narayan and Armstrong, 1993)

<**Thickness of aquifer**> Channel Sand: 3-4 metres; Parilla Sand: 30 metres

<**kv and kh of alluvial aquifer**> Channel Sand: Kh = 25 m/day (Narayan and Armstrong, 1993)

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> Water leaks from Lake Ranfurly through the Rufus Formation and into the Channel Sand at a rate of 360 ML/year (Cox, 1989). The water is intercepted before it reaches the River Murray by a line of interception bores which are part of the Mildura-Merbein Groundwater Interception Scheme and the water is disposed back into the lake. In addition, because of the irrigation mound above the trench Lake Ranfurly receives groundwater discharge from either the Parilla Sand or the Irymple Member of the Blanchetown Clay. Modelling of the lake by Narayan and Armstrong (1993), suggest that first the salt is concentrated in the lake due to evaporation, it then penetrates the Rufus Formation and enters the Channel Sand where it flows towards the river, where it is picked up by the interception bores and returned to the lake, in a cycle taking about 18 to 20 years. Problems of contamination could arise due to windows in the Upper Parilla Aquitard where the Channel Sand and Parilla Sand are in contact which could allow the highly saline water to enter the regional aquifer. Otherwise the groundwater is stopped by the interception scheme.

<**Hydraulic linkage to surface runoff**>

<Site Name> Lake Ranfurly West
<Synonyms>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Bluml, M., 1992- Sunraysia Salinity management Plan Environment report., Dept of Conservation and Environment, ISBN 0 7306 2715 2, 103 p.

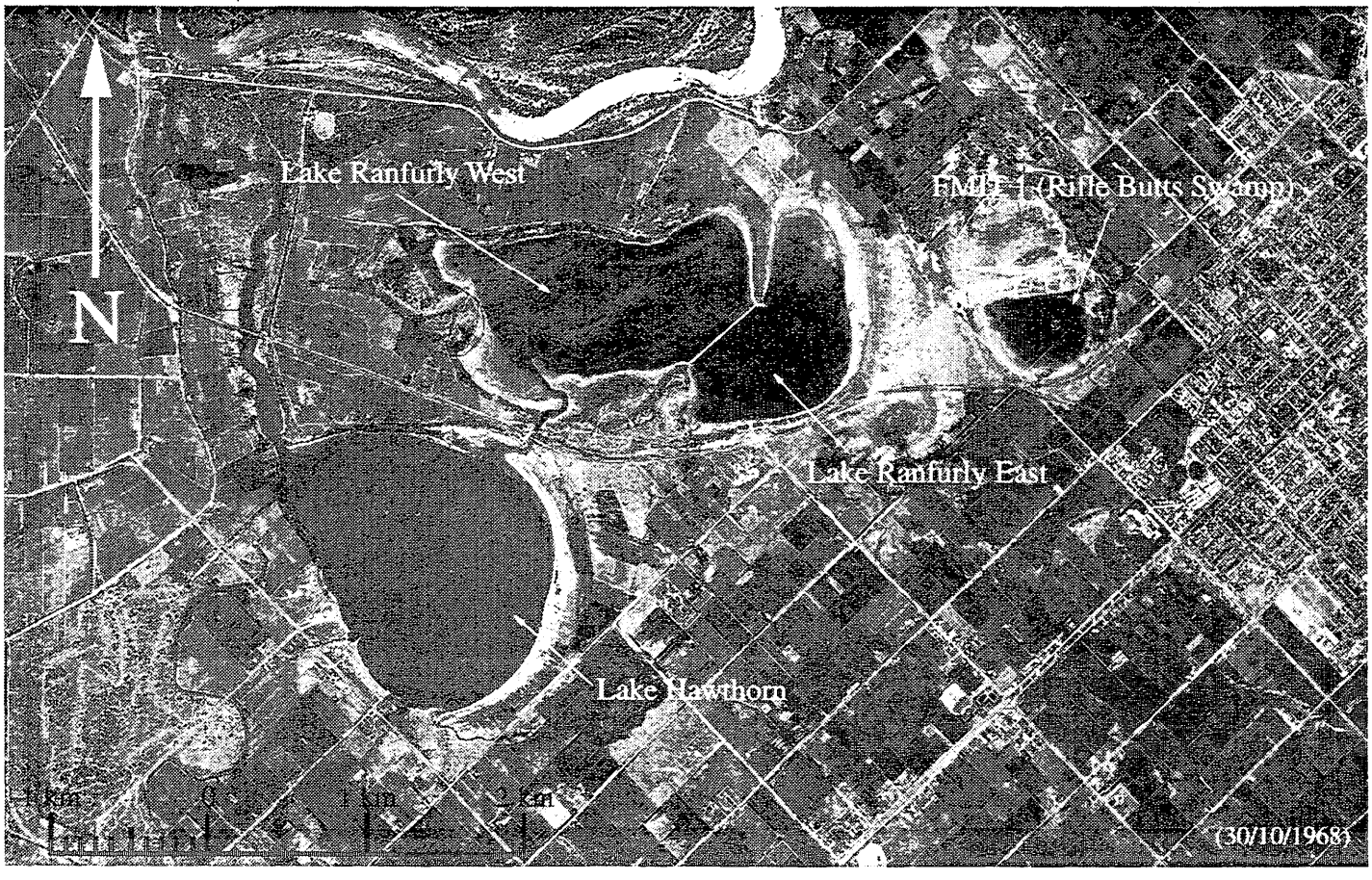
Cox, F., 1989- Mildura-Merbein Groundwater Interception Scheme north of Lake Ranfurly redesign of pumping bores., Rural Water Corporation Unpublished report 1989/28

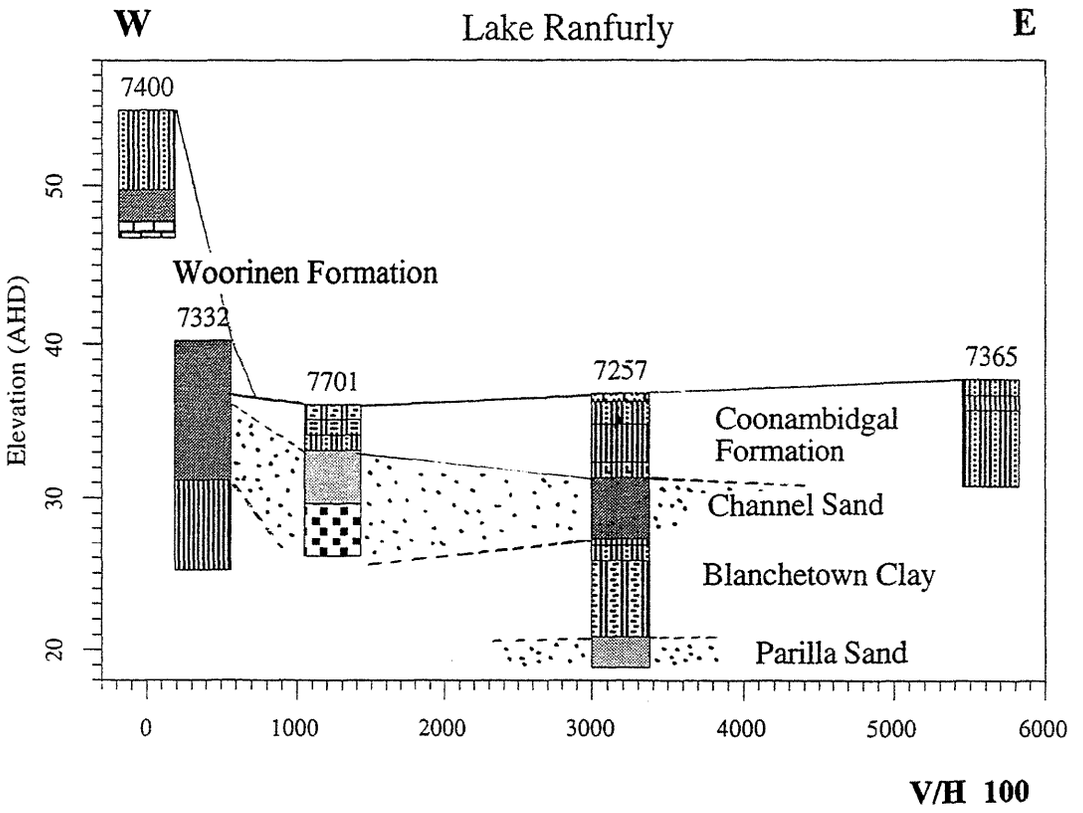
Gato, S. and Budahazy, M., 1992- Sunraysia salinity management plan: Lake Hawthorne scheme: alternate operational criteria., Rural Water Commission of Victoria report no. 1992/10

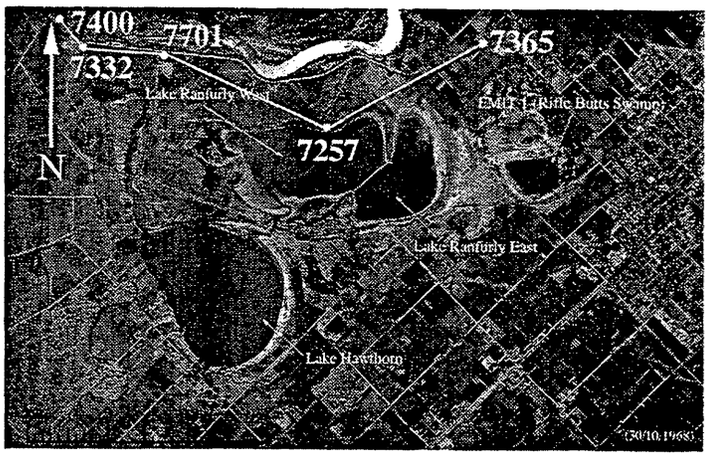
Narayan, K., and Armstrong, D., 1993- Simulation of groundwater interception at Lake Ranfurly, Victoria, incorporating variable density flow and solute transport., Centre for Groundwater Studies, Report 52

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

State Rivers and Water Supply Commission, Victoria (SR&WSC), 1974- Sunraysia Salinity Investigations., Unpublished report


Lake Ranfurly West
FMP 1 (Rifle Butts Swamp)
N
Lake Ranfurly East
Lake Hawthorn
1 Km
0
1 Km
2 Km
(30/10/1968)


W
Lake Ranfurly
E
7400
Woorinen Formation
7332
7701
7257
7365
Coonambidgal Formation
Channel Sand
Blanchetown Clay
Parilla Sand
Elevation (AHD)
50
40
30
20
0
1000
2000
3000
4000
5000
6000
V/H 100


7400
7701
7365
7332
Lake Ranfurly West
EMU 1 Rifle Butts Swamp
7257
N
Lake Ranfurly East
Lake Hawthorn

<Site Name> Lake Tutchewop
<Synonyms>

Spatial

<**Location description**> 6 kilometres west of Tresco, Victoria and 4.5 kilometres NE of Mystic Park, Victoria

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Swan Hill

<**Location 1:100 000**> Kerang 7626

<**Zone**> 54

<**Coordinates easting (AMG)**> 749500

<**Coordinates northing (AMG)**> 6066300

<**State**> Victoria

General

<**Year begun operation**> 1968

<**Active/inactive**> Active

<**Full surface area (ha)**> 1173 ha (all lakes combined), Lake Tutchewop: 775 ha

<**Volume capacity (ML)**> 19,700 ML (all lakes combined), Lake Tutchewop: 13,160 ML

<**Full surface level (m AHD)**> 70.1 m AHD

<**Groundwater level (m AHD)**> 70.5 to 71.5 m AHD (O'Rourke, 1992)

<**Groundwater seepage/discharge**> Mostly discharge although along northern margin there is some seepage (Dimos, 1992)

<**Average annual evaporation**> 11,500 ML/yr (74.6 %); net evaporation: 978 mm (Caldwell Connell Engineers Pty. Ltd., 1984); Inflow/evaporation = 0.7 (RWC, 1993a)

<**Volume disposed annually (ML/yr)**> 15,400 ML/yr (Caldwell Connell Engineers Pty. Ltd., 1984); 11,000 ML/yr (all basins) (RWC, 1993a)

<**Salinity of water disposed (EC)**> 5500 EC

<**Minimum salinity in basin (EC)**> Lake William, has three zones an upper zone 0.5 metres thick affected by present conditions, an intermediate zone dominated by past groundwater discharge of 100,000 mg/L, and a lower zone affected by regional salinities of 50,000 mg/L. The top two zones only were intersected in other lakes. Minimum porewater salinity Lake William (105,500 mg/L), Lake Kelly (80,000 mg/L), Lake Tutchewop (88,000 mg/L) (Ferguson, 1993). Range in basin 50,000-76,000 mg/L (Hoxley, et. al, 1989).

<**Sources of water to be disposed**> Saline water from the Kerang Lakes area intercepted to prevent flow into the Murray River.
<**Terminal/throughflow basin**> Throughflow

<**Range of elevation of lake surface with disposal**> Depth at full surface level is 1.7 metres, rising 5000 EC/yr

<Site Name> Lake Tutchewop
<Synonyms>

<Lining/treatment of base> None

<Review of environmental impacts> Pressure of Renmark Group into the Parilla Sand in the northern portion of the Lake may have contributed to the salinisation of the agricultural area. Significant decrease in the abundance and diversity of waterfowl, macrophytes, zooplankton, and phytoplankton since salinity increased (Caldwell Connell Engineers Pty. Ltd., 1984).

Engineering/Admin

<Public or private operation> Public

<Agency responsible> Rural Water Corporation

<Project name> Barr Creek Scheme

<Natural, modified natural or constructed> Natural

<Modification type and degree> None

Geological

<Site description and Geomorphology> Mallee Region, contains lunettes around the lakes and was once the semi-terminal system of the Loddon and Avoca Rivers.

<Subsurface investigations at site> Shepparton-38 bores; Parilla-10 bores; Renmark-3 bores

<Structural setting> The basin is located in the Kerang Lakes Trough and east of the Leaghur Fault (Pratt, 1988).

<Stratigraphic setting> The basin is floored by the Yamba Formation (1-3 m), and is underlain by the Shepparton Formation (40-50 m), the Parilla Sand (50-60 m), the Upper Renmark Group (Boga Silt 30 m) and the Renmark Group (120 metres) including up to 30 metres of coal (Barnewall and Brinkley, 1992).

<Host formation> Yamba Formation

<Host lithofacies> Clay salt and lunette deposits

<Aquitard> Shepparton Formation

<Aquitard lithofacies> Continuous layer of light brown sandy clay with minor occurrence of sand lenses.

<Aquifer> Parilla Sands and Shepparton Formation (in sandy lenses); Renmark Group

<Aquifer lithofacies> Parilla Sand: Fine to medium sand; Shepparton Formation: Isolated sand bodies consisting of fine to medium sand; Renmark Group: consists of quartz sands, gravels, ligneous clays and silts, with coal layers up to 30 metres thick. The upper section (Boga Silt), is a grey=green to olive-green clay and silt with associated black carbonaceous clay and silt and minor very fine to medium grained sand (Barnewall and Brinkley, 1992).

<Comments>

<Site Name> Lake Tutchewop
<Synonyms>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 7 kilometres

<**Head between basin and river/tributary**>

<**Direction of groundwater flow in regional aquifer**> Northeast controlled by geometry of the Parilla Sands (Dimos, 1992). In the Shepparton flow is to the northwest (Barnewall and Brinkley, 1992).

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**> Shepparton Formation: Kv = ~10^{-2} m/day; Kh = ~10^{-1} to 10^{-2} m/day (Harrison, in prep)

<**Thickness of aquitard**> Shepparton Formation: 50-60 metres

<**kv and kh of aquifer**> Parilla Sand: Kh = 2 m/day (O'Rourke, 1992)

<**EC of aquifer**> Renmark Group (40,000-50,000 mg/L TDS); Parilla Sand (14,500-54,000 mg/L TDS); Shepparton Formation (19,500-42,000 mg/L TDS) (Barnewall and Brinkley, 1992).

<**Porosity of aquifer**>

<**Thickness of aquifer**> Renmark Group: 130 metes; Parilla Sand: 50-60 metres; Shepparton Formation: Variable depending on presence or absence of sand bodies

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> The salinity of Lake Tutchewop ranges from 50,000 to 88,000 mg/L and has springs along its margins that are over 100,000 mg/L, while the salinity of the Shepparton Formation is 19,900-42,000 mg/L TDS, the Parilla Sand is 40,000-50,000 mg/L TDS, and the Renmark Group is 14,500-54,000 mg/L TDS (Ferguson, 1993; Barnewall and Brinkley, 1992). The Renmark Group is under pressure due to partial confinement by the Boga Silt and discharges into the Parilla Sand, while the pressure in the Parilla Sand is above the ground surface of the basin due to confinement by the Shepparton Formation. However, the situation is much more complex as the groundwater levels change with the seasons and in some places the Shepparton Formation actually discharges into the Parilla Sand and the Renmark Group (Harrison, in prep). The source of discharge into and/or around Lake Tutchewop is unknown. The salinity of the discharge water is much higher than the Parilla Sand, also the Parilla would have to travel through 40-50 metres of low permeability clay to enter the basin, which would necessitate some fracture enhanced porosity. Water from the Shepparton Formation is also much less saline than the discharge. However because of the long history of the area as the terminus of the Kerang Lakes System hypersaline water may be stored in the Shepparton Formation (within the clay and silt or the sand lenses). The water may be being mobilised due to irrigation activity and/or pressure from the Parilla Sand. Another possibility is that the discharge comes from the lake itself due to higher than normal levels (Harrison, in prep) although salinity profiling suggests a more complex behaviour (Ferguson, 1993).

<**Hydraulic linkage to surface runoff**> Spring Discharge within 100 metres of the lake coincide with the discharge of the effluent causing a groundwater bulge and increased head from 1 to 2.4 metres into the lake. Spring discharge appears to be from the Shepparton Formation (Ferguson, 1993).

<Site Name> Lake Tutchewop
<Synonyms>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus> Annual evaporation 11,500 ML/yr while input 15,400 ML/yr

Interpretive 2

<Ranking of sustainability>

References Cited

Barnewall, K., and Brinkley, A., 1992- Lake Tutchewop Disposal Complex hydrogeological and groundwater monitoring review, Unpublished report number 1992/ , Rural Water Commission, 14 pp.

Caldwell Connell Engineers Pty. Ltd., 1984- Salt harvesting at the mineral reserve basins, Unpublished report, State Rivers and Water Supply Commission of Victoria, 18 pp.

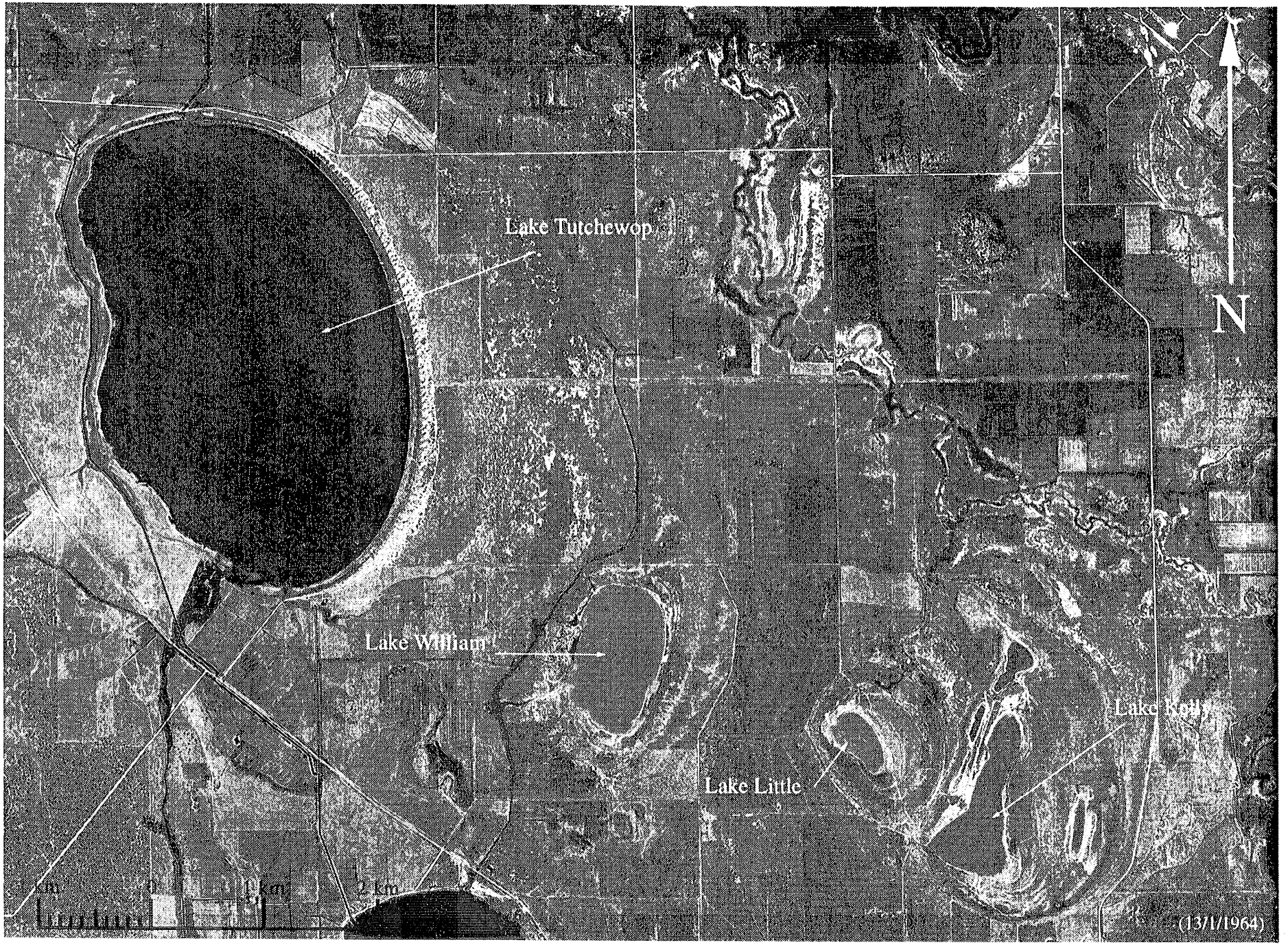
Dimos, Alexandra, 1992- Lake Tutchewop investigation of possible salinisation to neighbouring region by Lake Tutchewop, Rural Water Corporation, Technical Services, Technical Report No. 1992/TN/71/92, 68 pp.

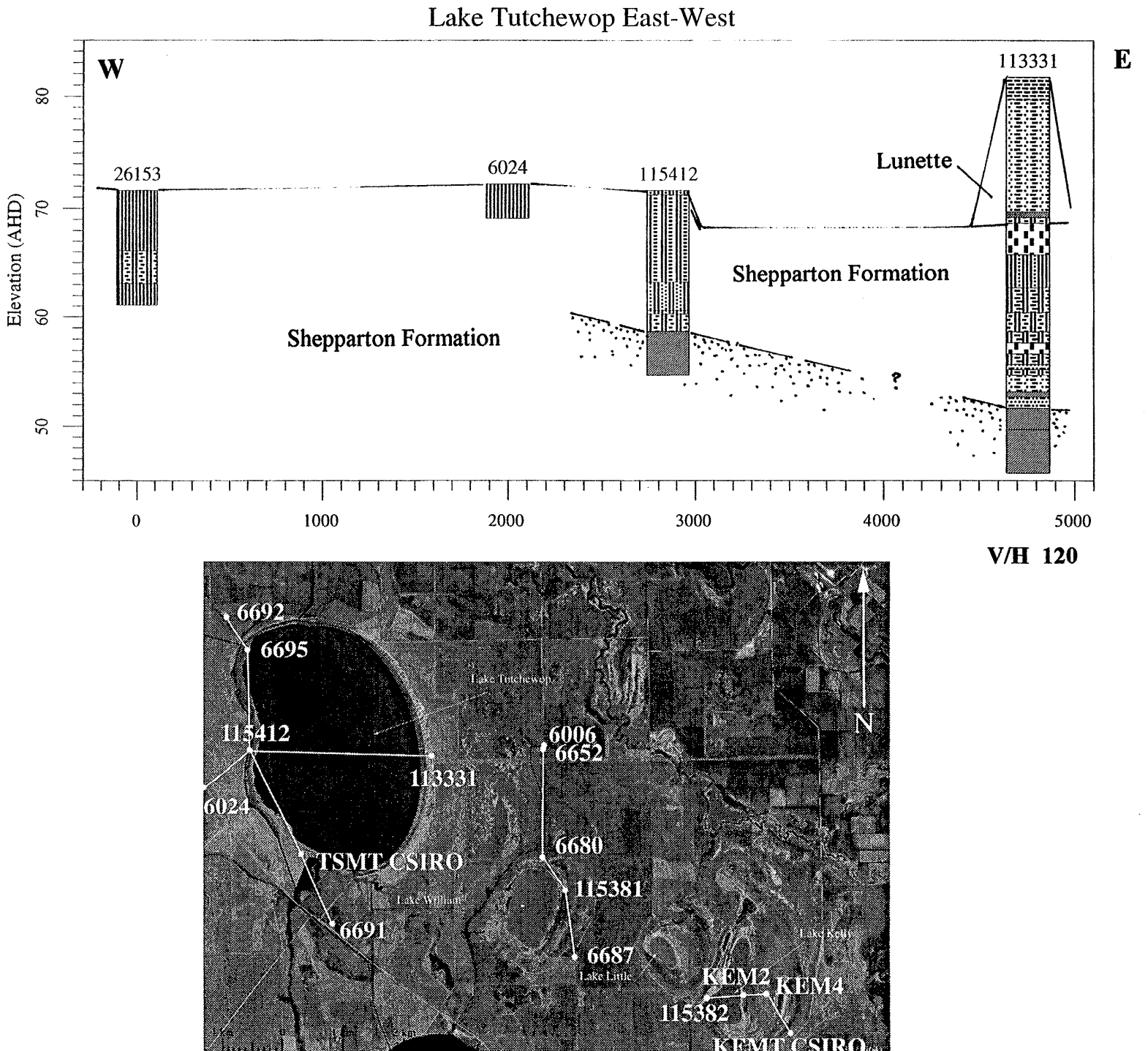
Ferguson, J., 1993- Hydrodynamics of the Lake Tutchewop salt disposal complex, Murray Basin, Preliminary Report on AGSO Investigations, 6 pp.

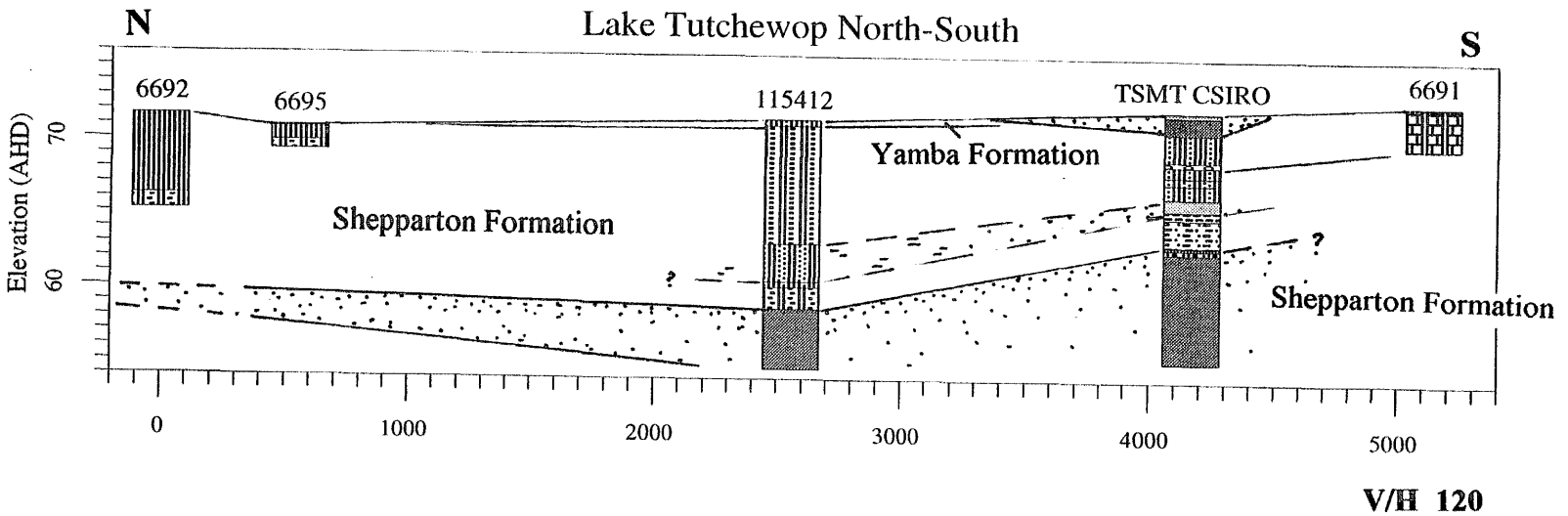
Harrison, A., in prep- Lake Tutchewop hydrogeological investigation., Rural Water Corporation (Hydrotechnology), Unpublished report

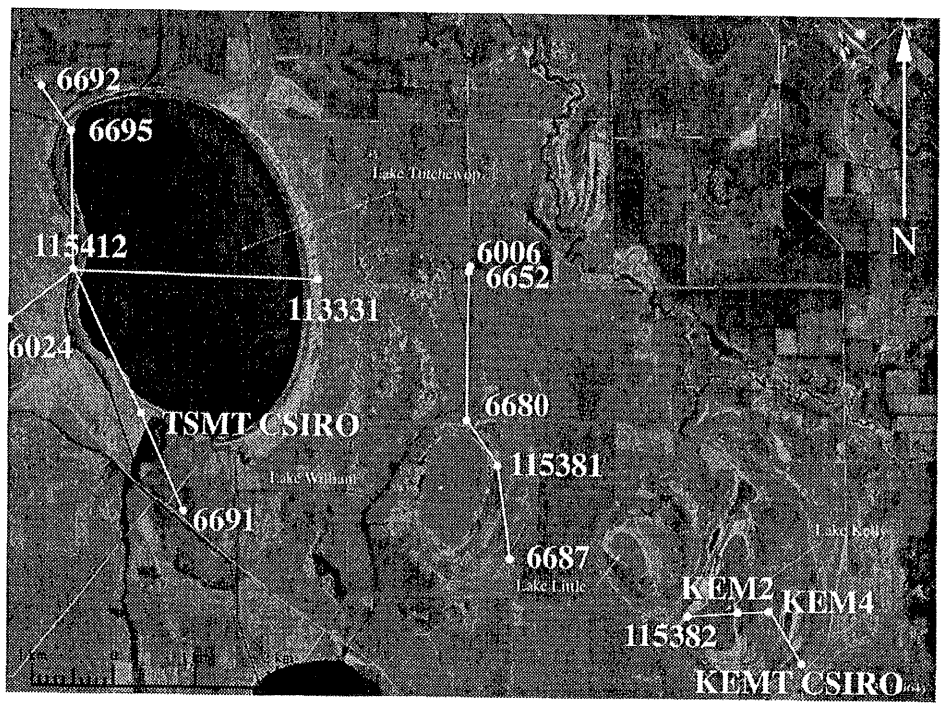
Hoxley, G., Ife, D., and Pratt, M., 1989- Kerang Lakes Area hydrogeological assessment., Rural Water Corporation, Draft report

O'Rourke, M.E., et. al, Victorian Rural Water Commission, 1992- Swan Hill Hydrogeological Map (1:250,000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra Australia


Lake Tutchewop
Lake William
Lake Little
Lake Roll
N
km
1 km
2 km
(13/1/1964)


Lake Tutchewop East-West
W
E
113331
Lunette
26153
6024
115412
Shepparton Formation
Shepparton Formation
Elevation (AHD)
80
70
60
50
0
1000
2000
3000
4000
5000
V/H 120
6692
6695
115412
113331
6024
6006
6652
6680
TSMT-CSIRO
115381
6691
6687
Lake Little
KEM2
KEM4
115382
KEMT CSIRO
N


N
Lake Tutchewop North-South
S
6692
6695
115412
TSMT CSIRO
6691
Yamba Formation
Shepparton Formation
Shepparton Formation
Elevation (AHD)
70
60
0
1000
2000
3000
4000
5000
V/H 120


6692
6695
115412
113331
6024
TSMT CSIRO
6691
6006
6652
6680
115381
6687
KEM2
KEM4
115382
KEMT CSIRO
N

<Site Name> Lake William
<Synonyms>

Spatial

<Location description> 6 kilometres ENE of Mystic Park, Victoria and 11 kilometres ESE of Tresco, Victoria

<Located in Murray Trench> No

<Location 1:250 000> Swan Hill

<Location 1:100 000> Kerang 7626

<Zone> 54

<Coordinates easting (AMG)> 752400

<Coordinates northing (AMG)> 6063700

<State> Victoria

General

<Year begun operation> 1968

<Active/inactive> Active

<Full surface area (ha)> 108 ha

<Volume capacity (ML)> 2700 ML

<Full surface level (m AHD)> 70.106 m AHD

<Groundwater level (m AHD)> ~70.8 m AHD (O'Rourke, 1992)

<Groundwater seepage/discharge> Seepage and discharge

<Average annual evaporation> Inflow/evaporation = 0.7

<Volume disposed annually (ML/yr)> 11,000 ML/yr (for all basins)

<Salinity of water disposed (EC)> 7000 EC

<Range of salinity in basin (EC)> 40,000-196,980 EC

<Sources of water to be disposed> Barr Creek

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal> Mean depth 2.5 metres

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> Lake William
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Barr Creek Scheme

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**>

<**Structural setting**> The basin is located in the Kerang Lakes Trough and east of the Leaghur Fault (Pratt, 1988).

<**Stratigraphic setting**> The basin is floored by the Yamba Formation (1-3 m), and is underlain by the Shepparton Formation (40-50 m), the Parilla Sand (50-60 m), the Upper Renmark Group (Boga Silt 30 m) and the Renmark Group (120 metres) including up to 30 metres of coal (Barnewall and Brinkley, 1992).

<**Host formation**> Yamba Formation

<**Host lithofacies**> Clay salt and lunette deposits

<**Aquitard**> Shepparton Formation

<**Aquitard lithofacies**> Continuous layer of light brown sandy clay with minor occurrence of sand lenses.

<**Aquifer**> Parilla Sands and Shepparton Formation (in sandy lenses); Renmark Group

<**Aquifer lithofacies**> Parilla Sand: Fine to medium sand; Shepparton Formation: Isolated sand bodies consisting of fine to medium sand; Renmark Group: consists of quartz sands, gravels, ligneous clays and silts, with coal layers up to 30 metres thick. The upper section (Boga Silt), is a grey-green to olive-green clay and silt with associated black carbonaceous clay and silt and minor very fine to medium grained sand (Barnewall and Brinkley, 1992).

<**Comments**> Data is shared among Lake Little, Lake Kelly, Lake William, and Lake Tutchewop.

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 5 kilometres

<**Head between basin and river/tributary**>

<**Direction of groundwater flow in regional aquifer**> Northeast controlled by geometry of the Parilla Sands (Dimos, 1992). In the Shepparton flow is to the northwest (Barnewall and Brinkley, 1992)

<**kv of artificial floor**>

<Site Name> Lake William
<Synonyms>

<kv and kh of host>

<kv and kh of aquitard> Shepparton Formation: Kv = ~10^{-2} m/day; Kh = ~10^{-1} to 10^{-2} m/day (Harrison, in prep)

<Thickness of aquitard> Shepparton Formation: 50-60 metres

<kv and kh of aquifer> Parilla Sand: Kh = 2 m/day (O'Rourke, 1992)

<EC of aquifer> Renmark Group (40,000-50,000 mg/L TDS); Parilla Sand (14,500-54,000 mg/L TDS); Shepparton Formation (19,500-42,000 mg/L TDS) (Barnewall and Brinkley, 1992).

<Porosity of aquifer>

<Thickness of aquifer> Renmark Group: 130 metes; Parilla Sand: 50-60 metres; Shepparton Formation: Variable depending on presence or absence of sand bodies

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The salinity of Lake William is from 40,000 to 196,000 EC and has a brine beneath the surface of about 100,000 mg/L, it also receives highly saline discharge (>100,000 mg/L). The salinity of the Shepparton Formation is 19,900-42,000 mg/L TDS, the Parilla Sand is 40,000-50,000 mg/L TDS, and the Renmark Group is 14,500-54,000 mg/L TDS (Ferguson, 1993; Barnewall and Brinkley, 1992). The Renmark Group is under pressure due to partial confinement by the Boga Silt and discharges into the Parilla Sand. While the pressure in the Parilla Sand is above the ground surface of the basin due to confinement by the Shepparton Formation. However, the situation is much more complex as the groundwater levels change with the seasons and in some place the Shepparton Formation actually discharges into the Parilla Sand and the Renmark Group (Harrison, in prep). The source of discharge into and/or around Lake William is unknown. The salinity of the discharge water is much higher than the Parilla Sand (also the Parilla would have to travel through 40-50 metres of low permeability clay to enter the basin necessitating some fracture enhanced porosity). Water from the Shepparton Formation is also much less saline than the discharge, however because of the long history of the area as the terminus of the Kerang Lakes System hypersaline water may be stored in the Shepparton Formation from two previous lake stages (within the clay and silt or the sand lenses). The water may be being mobilised due to irrigation activity and/or pressure from the Parilla Sand. Another possibility is that the discharge comes from the lake itself due to higher than normal levels (Harrison, in prep) although salinity profiling suggests a more complex suggests behaviour (Ferguson, 1993).

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

<Site Name> Lake William
<Synonyms>

Interpretive 2

<Ranking of sustainability>

References Cited

Barnewall, K., and Brinkley, A., 1992- Lake Tutchewop Disposal Complex hydrogeological and groundwater monitoring review, Unpublished report number 1992/ , Rural Water Commission, 14 pp.

Caldwell Connell Engineers Pty. Ltd., 1984- Salt harvesting at the mineral reserve basins, Unpublished report, State Rivers and Water Supply Commission of Victoria, 18 pp.

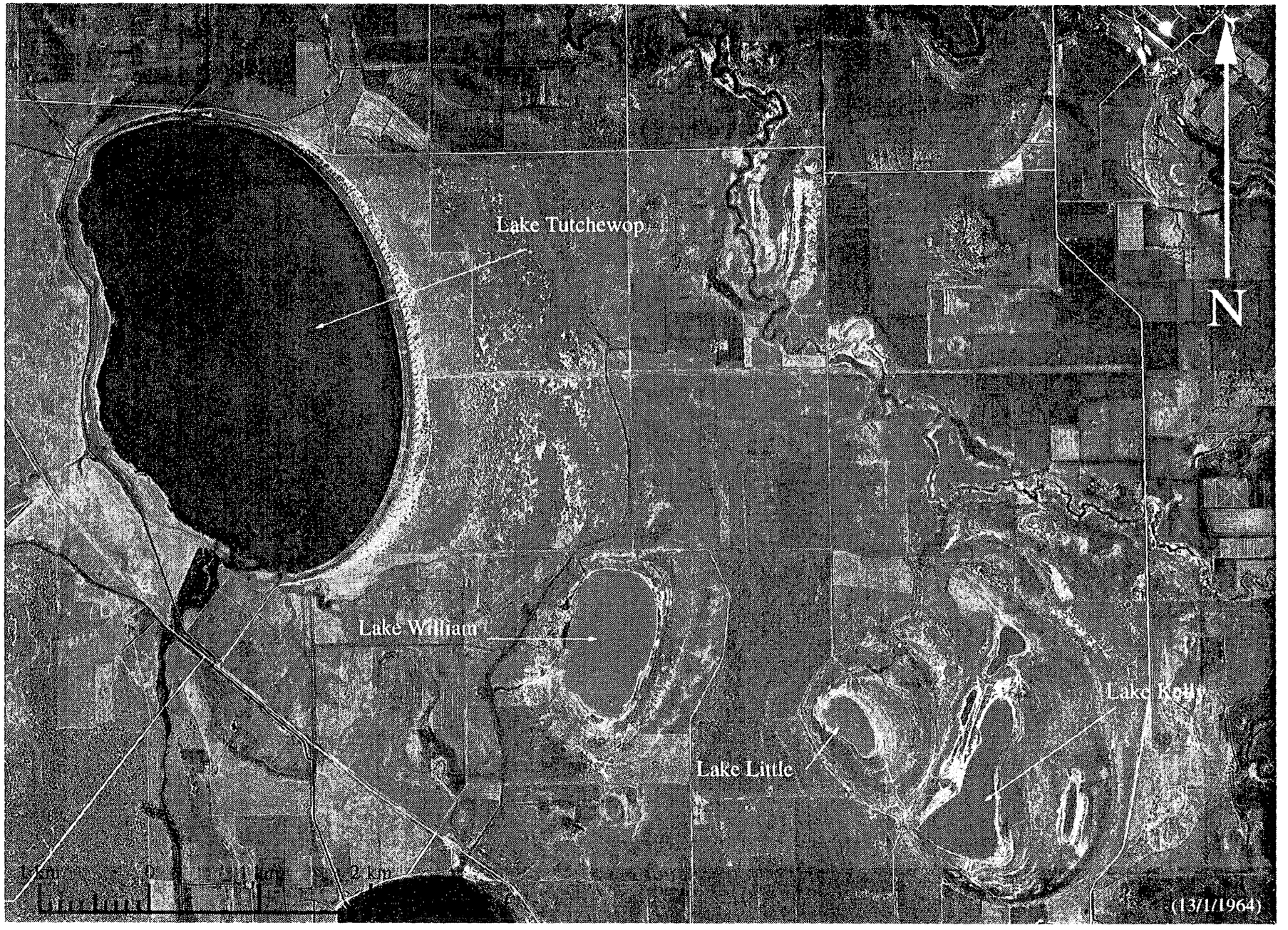
Dimos, Alexandra, 1992- Lake Tutchewop investigation of possible salinisation to neighbouring region by Lake Tutchewop, Rural Water Corporation, Technical Services, Technical Report No. 1992/TN/71/92, 68 pp.

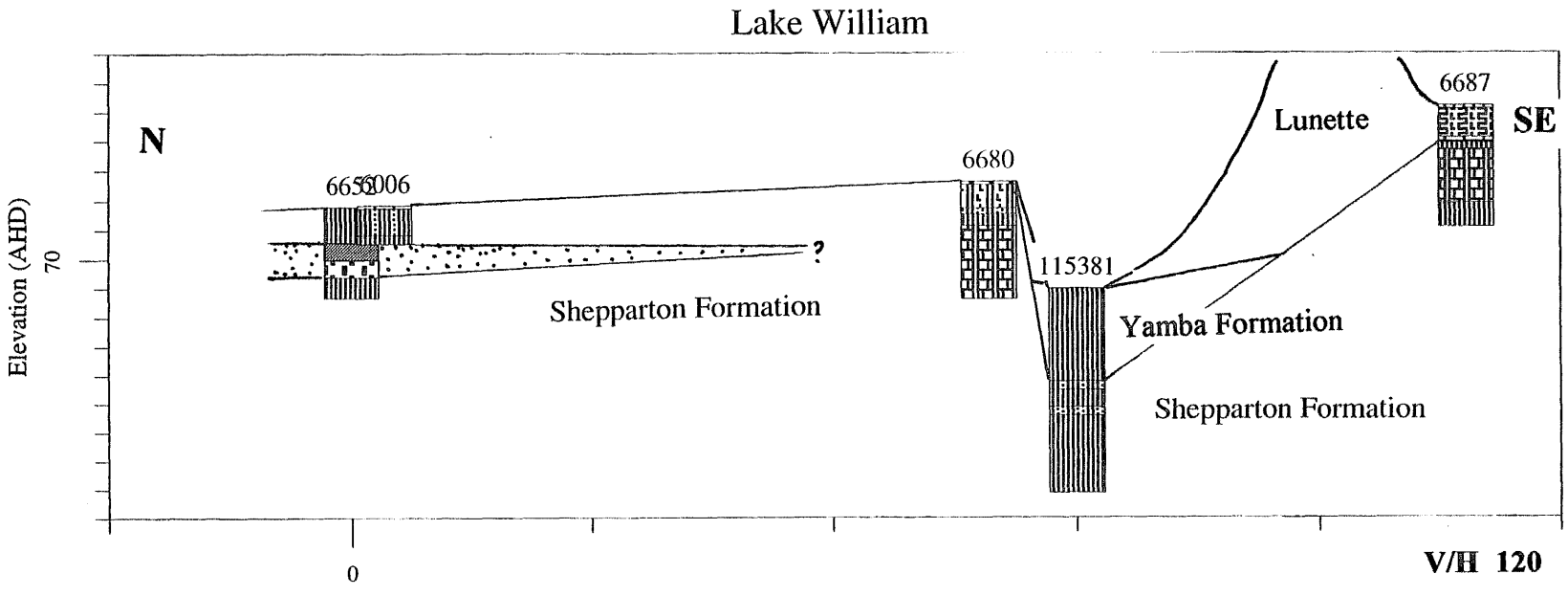
Ferguson, J., 1993- Hydrodynamics of the Lake Tutchewop salt disposal complex, Murray Basin, Preliminary Report on AGSO Investigations, 6 pp.

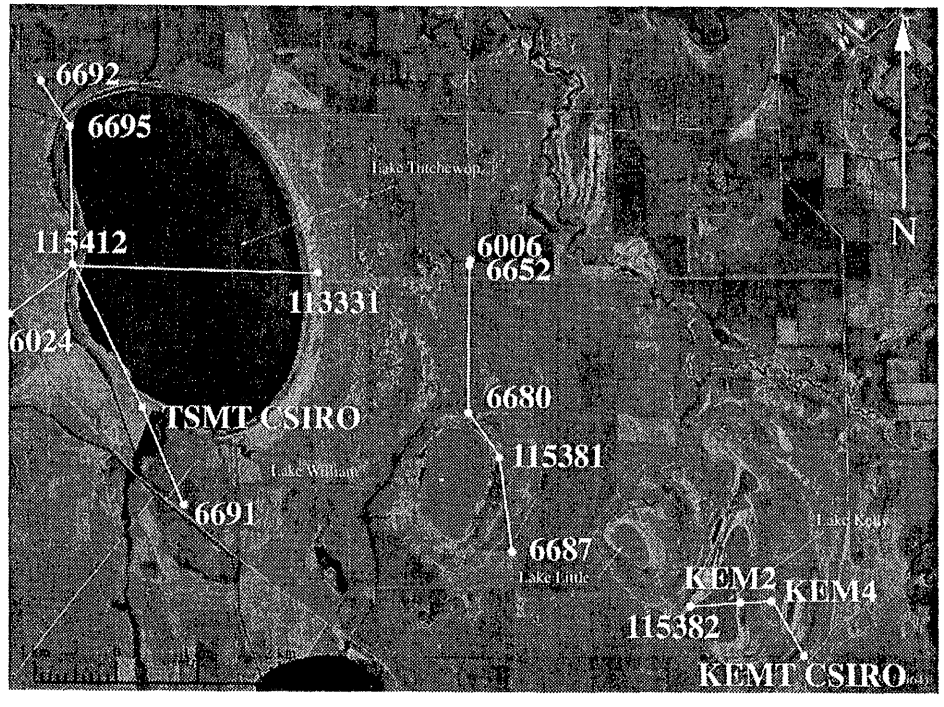
Harrison, A., in prep- Lake Tutchewop hydrogeological investigation., Rural Water Corporation (Hydrotechnology), Unpublished report

Hoxley, G., Ife, D., and Pratt, M., 1989- Kerang Lakes Area hydrogeological assessment., Rural Water Corporation, Draft report

O'Rourke, M.E., et. al, Victorian Rural Water Commission, 1992- Swan Hill Hydrogeological Map (1:250,000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra Australia


Lake Tutchewop
Lake William
Lake Little
Lake Kelly
N
1 km
0
1 km
2 km
(13/1/1964)


Lake William
N
SE
6652
6006
6680
6687
Lunette
115381
Yamba Formation
Shepparton Formation
Shepparton Formation
?
Elevation (AHD)
70
0
V/H 120


6692
6695
115412
113331
6024
TSMT CSIRO
6691
6006
6652
6680
115381
6687
KEM2
KEM4
115382
KEMT CSIRO
N

<Site Name> Lamberts Swamp
<Synonyms> Merbein 3

Spatial

<Location description> ~5.5 kilometres WNW of Merbein, Victoria east of the railway line

<Located in Murray Trench> No

<Location 1:250 000> Mildura

<Location 1:100 000> Mildura 7329

<Zone> 54

<Coordinates easting (AMG)> 593500

<Coordinates northing (AMG)> 6220000

<State> Victoria

General

<Year begun operation> 1920's

<Active/inactive> Active

<Full surface area (ha)> 16 ha

<Volume capacity (ML)> 70 ML

<Full surface level (m AHD)> 32.67 m AHD

<Groundwater level (m AHD)> 35.0 m AHD

<Groundwater seepage/discharge> Discharge

<Average annual evaporation> Inflow/evaporation = 0.7

<Volume disposed annually (ML/yr)> 109 ML/yr

<Salinity of water disposed (EC)> 3000-48,600 EC average 20,000 EC (irrigation season) and 26,000 EC (non-irrigation season) (Linke, Gato, and Northey, 1991b)

<Range of salinity in basin (EC)> 17,200-160,000 EC

<Sources of water to be disposed> Tile drainage from 52 ha area east of the swamp; natural discharge from the Parilla Sand

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts> The area surrounding the basin and the outfall channel appear to be degraded. Water from the swamp can be disposed via the west drain into the River Murray, or 15 kilometres southwest into the Wargan Basins (proposed) (Linke, Gato, and Northey, 1991b).

<Site Name> Lamberts Swamp
<Synonyms> Merbein 3

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Commission

<**Project name**> Lambert's Swamp

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Water is pumped from the swamp is pumped into an outfall channel to control water levels in the basin, and allow continuing tile drainage.

Geological

<**Site description and Geomorphology**> The basin lies within a 10 metre deep, northwest trending trench that has been covered with aeolian material. The trench was either developed as a localised drainage line across Lake Bungunnia, or as a system prior to the formation of the Murray Trench. The trench has cut through the Blanchetown Clay and incised into the Parilla Sand, allowing the Parilla Sand to act as an unconfined aquifer. Because of the large irrigation mound (and high potential) in the Parilla Sand under the Mildura area, Lamberts Swamp acts as a discharge zone. Lamberts Swamp, has probably also acted as a discharge zone in the past, during periods of high water (Thorne, Hoxley, and Chaplin, 1990).

<**Subsurface investigations at site**>

<**Structural setting**> Lamberts Swamp is located on the Merbein Ridge, east of the Yelta Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (10 m), and is underlain by the Parilla Sand (32 m), the Bookpurnong Beds/Geera Clay/Winnambool Formation (110 m), the Murray Group Limestone, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation on margins with Parilla Sand underneath swamp

<**Host lithofacies**> Woorinen Formation: Brown quartz sand and clay; Parilla Sand: medium to fine grained quartz sand

<**Aquitard**> Bookpurnong Beds/Geera Clay/Winnambool Formation

<**Aquitard lithofacies**>

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to coarse grained, cross bedded quartz sand (Thorne, Hoxley, and Chaplin, 1990)

<**Comments**> Water levels controlled by pumping into Merbein West Drain

<Site Name> Lamberts Swamp
<Synonyms> Merbein 3

Summary of Hydrodynamics

<Distance to Murray or tributary>

<Head between basin and river/tributary> Area is a discharge zone, so is not connected to the river.

<Direction of groundwater flow in regional aquifer> Estimated discharge into Lamberts Swamp via the Parilla Sand ranges from 153 to 613 ML/year depending on hydraulic conductivity of the Parilla Sand (Linke, Gato, and Northey, 1991b).

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Bookpurnong Beds: 110 metres

<kv and kh of aquifer>

<EC of aquifer> 10,000 mg/L TDS (RWC, 1993); 60,000 EC (From salt balance in Linke, Gato, and Northey, 1991b); 30,000-35,000 mg/L TDS (Hoxley, 1991)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 32 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The Merbein Ridge is a major hydraulic barrier to westerly flowing groundwater In the Renmark Group. Therefore, the saturated thickness in the Parilla Sand west of the fault is much lower because of the limited input from the Renmark Group and the low potential. However, the Merbein-Red Cliffs Irrigation Area has induced a 11-12 metre high groundwater mound in the Parilla Sand causing radial flow away from Merbein. Where windows appear in the confined part of the Parilla Sand (i.e. Lamberts Swamp) the high gradient causes discharge to occur (Thorne, Hoxley, and Chaplin, 1990).

<Site Name> Lamberts Swamp
<Synonyms> Merbein 3

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability> The Merbein area has had stable groundwater for the past 10 years

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

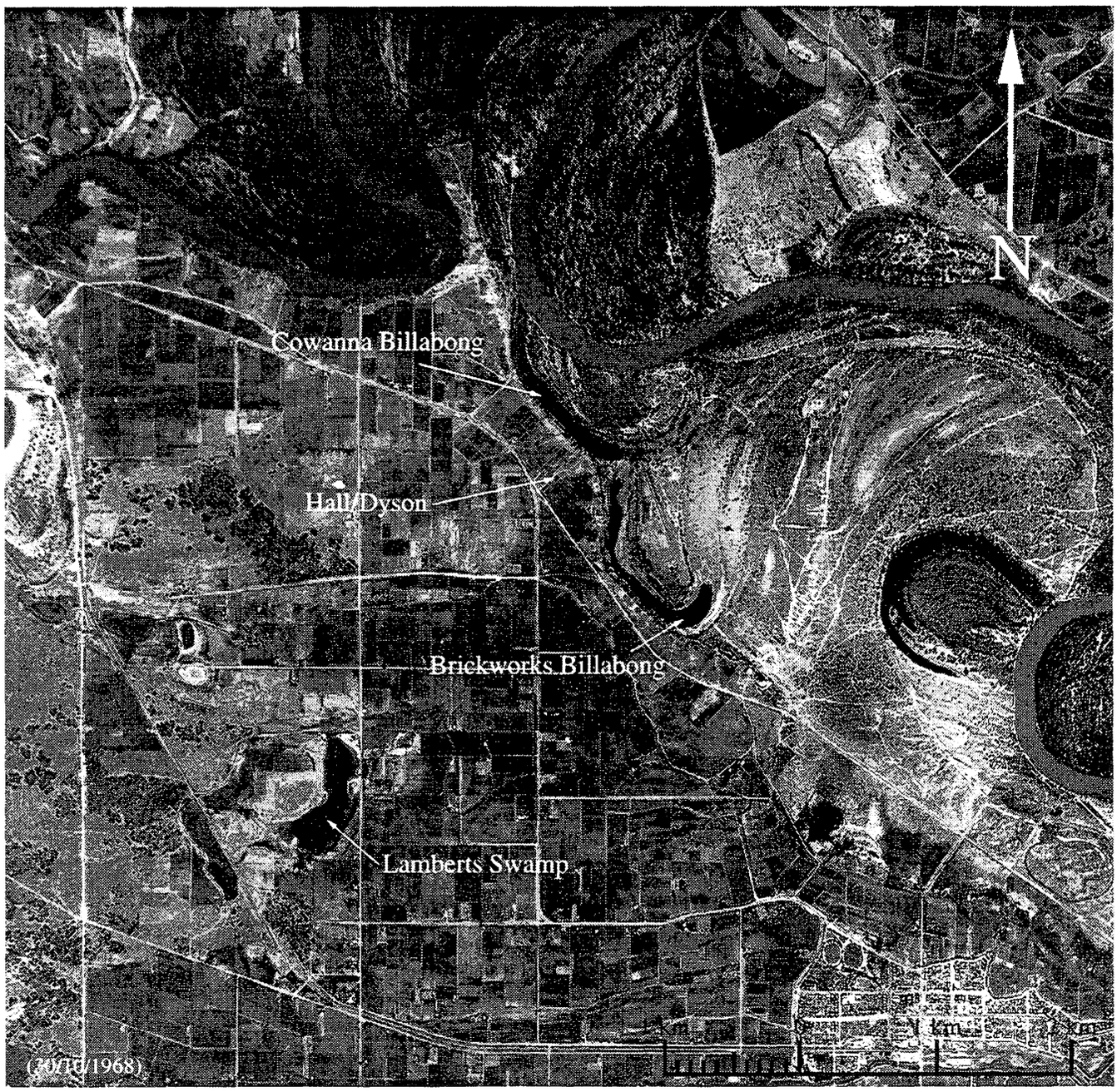
References Cited

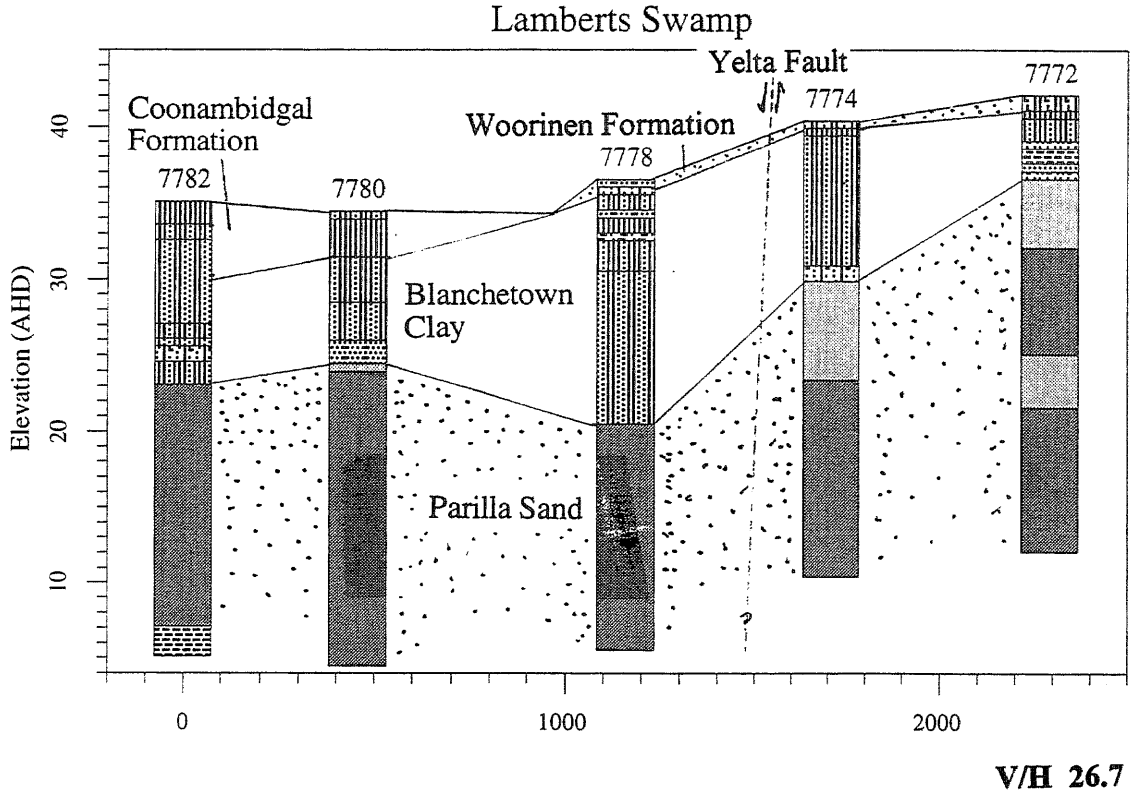
Hoxley, G., 1991- Hydrogeological summary of wetland areas in the Sunraysia Salinity Management Plan Area., Rural Water Corporation, Groundwater Section, Technical note 2

Linke, G.K., Gato, S., and Northey, P., 1991b- Evaluation of drainage disposal options for Merbein., Rural Water Commission of Victoria Report 1991/25

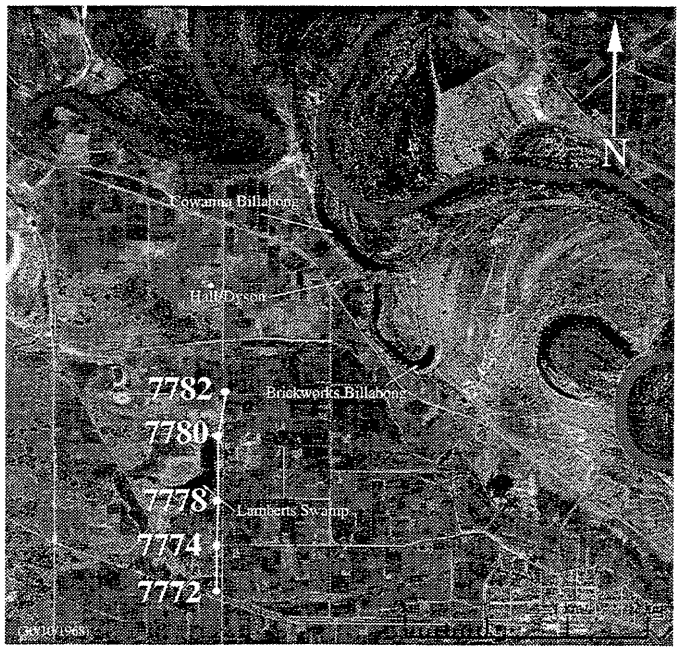
Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
Cowanna Billabong
Hall/Dyson
Brickworks Billabong
Lamberts Swamp
1 km
(30/10/1968)


Lamberts Swamp
Yelta Fault
7772
Coonambidgal Formation
Woorinen Formation
7774
7778
7782
7780
Blanchetown Clay
Parilla Sand
Elevation (AHD)
40
30
20
10
0
1000
2000

V/H 26.7


N
Powarna Billabong
Hall Dyson
Brickworks Billabong
7782
7780
7778
Lamberts Swamp
7774
7772

<Site Name> Lindsay Point
<Synonyms>

Spatial

<Location description> 500 metres east of Lindsay Point, Victoria, and ~20 kilometres southwest of Lake Victoria

<Located in Murray Trench> Yes

<Location 1:250 000> Mildura

<Location 1:100 000> Lindsay 7129

<Zone> 54

<Coordinates easting (AMG)> 502300

<Coordinates northing (AMG)> 6227500

<State> Victoria

General

<Year begun operation>

<Active/inactive> Active

<Full surface area (ha)> 3 ha

<Volume capacity (ML)>

<Full surface level (m AHD)>

<Groundwater level (m AHD)>

<Groundwater seepage/discharge>

<Average annual evaporation>

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)> 3000 EC

<Range of salinity in basin (EC)>

<Sources of water to be disposed> Tile drainage

<Terminal/throughflow basin> Flushed during high river flows?

<Range of elevation of lake surface with disposal>

<Lining/treatment of base>

<Review of environmental impacts>

<Site Name> Lindsay Point
<Synonyms>

Engineering/Admin

<**Public or private operation**> Private

<**Agency responsible**>

<**Project name**> Lindsay Point

<**Natural, modified natural or constructed**> Constructed

<**Modification type and degree**>

Geological

<**Site description and Geomorphology**> The Lindsay River is an anabranch of the River Murray located southwest of Lake Victoria. The trench widens to about 12 kilometres between the rivers forming Lindsay Island and then narrows to <500 metres at the confluence. There are four alluvial terraces present (T3 to T0), the oldest associated with the Shepparton Formation (Rufus Terrace), and the other three associated with the Coonambidgal Formation (Green Gully-Kotupna Phase, Goulburn Phase, and Late Goulburn Phase (Duncan and Linke, 1992). The Rufus Terrace is mantled with Woorinen dune and lies 7 metres higher than the trench while the Coonambidgal Terraces consist of grey silts and clays. Lindsay Point is an elongated billabong along the Lindsay River underlain by the Coonambidgal Formation and backed to the south by the Rufus Terrace.

<**Subsurface investigations at site**>

<**Structural setting**> Lindsay Point is located northwest of the Wentworth Trough and northeast of the Millewa Ridge (Parilla strandline) (Thorne, Hoxley, and Chaplin, 1990)

<**Stratigraphic setting**> The basin is floored by the Coonambidgal Formation (3-7 m), and is underlain by the Channel Sand (3-11 m), the Blanchetown Clay (0-5 m), the Parilla Sand (30-50 m), the Bookpurnong Beds, and the Duddo Limestone (Calcarenite) (Dudding, Oakes, and Thorne, 1989).

<**Host formation**> Coonambidgal Formation

<**Host lithofacies**> Grey silts and clays

<**Aquitard**> Coonambidgal Formation, and Bookpurnong Beds

<**Aquitard lithofacies**> Grey silts and clays

<**Aquifer**> Channel Sand (Monoman Formation) and Parilla Sand

<**Aquifer lithofacies**> Channel Sand: Clean medium to coarse grained sand; Parilla Sand: Medium to coarse grained sand

<**Comments**>

<Site Name> Lindsay Point
<Synonyms>

Summary of Hydrodynamics

<Distance to Murray or tributary> On floodplain

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Southwest due to Lake Victoria

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Coonambidgal Formation: 3-7 metres

<kv and kh of aquifer>

<EC of aquifer> Channel Sand: 7,000 to 26,000 EC (Bores 27109 and 27108 respectively)

<Porosity of aquifer>

<Thickness of aquifer> Channel Sand: 3-11 metres; Parilla Sand: 30-50 metres (140 metres at Millewa Ridge)

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin is separated from the Channel Sand aquifer by the Coonambidgal Formation, which due to its variability can be a leaky aquitard. The Channel Sand is in direct contact with the Parilla Sand potentially allowing contamination to occur. However, because of the small volumes of water disposed (estimated) and the southwesterly direction of flow in the Parilla Sand this should not be a problem. Salinity in the Parilla is also quite high making groundwater interception a much higher priority than infiltration of disposal water.

<Hydraulic linkage to surface runoff> The basin will be flooded during high river flows.

<Category - hydraulic stability>

<Site Name> Lindsay Point
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Dudding, M., 1990- Lindsay River Salinity Assessment Progress Report No. 2., Rural Water Corporation, Unpublished report 1990/57.

Dudding, M., Oakes, A., and Thorne, R., 1989- Lindsay River Salinity Assessment Report., Rural Water Corporation, Unpublished report 1989/23.

Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.

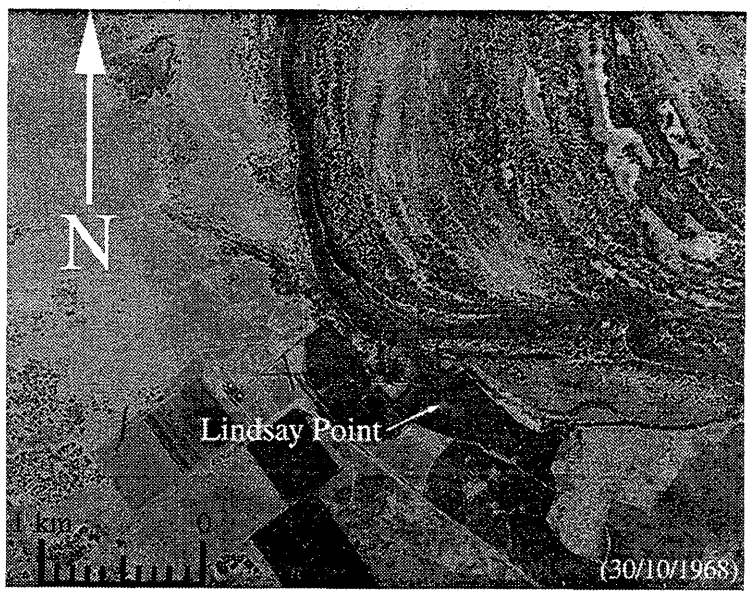
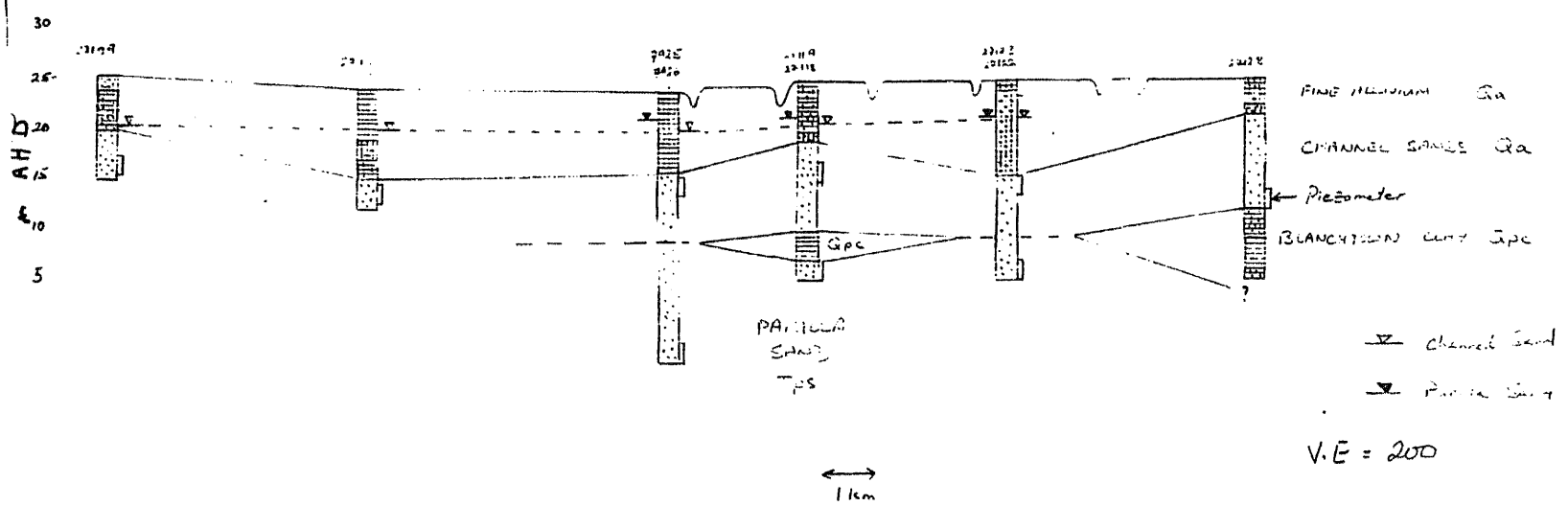

N
Lindsay Point
1 km
0
(30/10/1968)

FIG. 6

GEOLOGY OF LINDSAY RIVER : Section Along River



(Dudding, 1990)

<Site Name> Margooya Lagoon
<Synonyms>

Spatial

<Location description> 7 kilometres southeast of Robinvale, Victoria

<Located in Murray Trench> Yes

<Location 1:250 000> Balranald

<Location 1:100 000> Robinvale7428

<Zone> 54

<Coordinates easting (AMG)> 669200

<Coordinates northing (AMG)> 6166100

<State> Victoria

General

<Year begun operation>

<Active/inactive>

<Full surface area (ha)>

<Volume capacity (ML)>

<Full surface level (m AHD)>

<Groundwater level (m AHD)> 47 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<Groundwater seepage/discharge>

<Average annual evaporation>

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)>

<Sources of water to be disposed>

<Terminal/throughflow basin>

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> Margooya Lagoon
<Synonyms>

Engineering/Admin

<Public or private operation> Public

<Agency responsible>

<Project name> Margooya Lagoon

<Natural, modified natural or constructed>

<Modification type and degree>

Geological

<Site description and Geomorphology> Margooya Lagoon consists of two connected stranded meander loops on the River Murray floodplain.

<Subsurface investigations at site>

<Structural setting> The basin is locted east of the Tyrrell Fault and west of the Tyrrell Trough (Thorne, Hoxley, and Chaplin, 1990)

<Stratigraphic setting> The basin is floored by the Coonambidgal Formation (8 m), and is underlain by the Channel Sand (Monoman Formation) (8 m), the Blanchetown Clay (50 m), the Parilla Sand (80 m), the Bookpurnong Beds, the Murray Group Limestone, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<Host formation> Coonambidgal Formation

<Host lithofacies> Fine sand, clayey sand, sandy clay, and clay

<Aquitard> Coonambidgal Formation, Blanchetown Clay

<Aquitard lithofacies> Coonambidgal Formation: sandy clay and clay; Blanchetown Clay: grey clay

<Aquifer> Channel Sand and Parilla Sand

<Aquifer lithofacies> Fine to coarse sand

<Comments>

Summary of Hydrodynamics

<Distance to Murray or tributary> <500 metres

<Head between basin and river/tributary> On floodplain

<Site Name> Margooya Lagoon
<Synonyms>

<Direction of groundwater flow in regional aquifer> North to northeast towards the river (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Coonambidgal Formation: 5-10 metres; Blanchetown Clay: 50 metres

<kv and kh of aquifer>

<EC of aquifer> > 50,000 mg/L TDS (RWC, 1993a)

<Porosity of aquifer>

<Thickness of aquifer> Channel Sand: 8 metres; Pariila Sand: 80 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Not much is known about the basin, however if it is kept at or below river level, there should be little salinisation of the floodplain.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

<Site Name> Margooya Lagoon
<Synonyms>

Interpretive 2

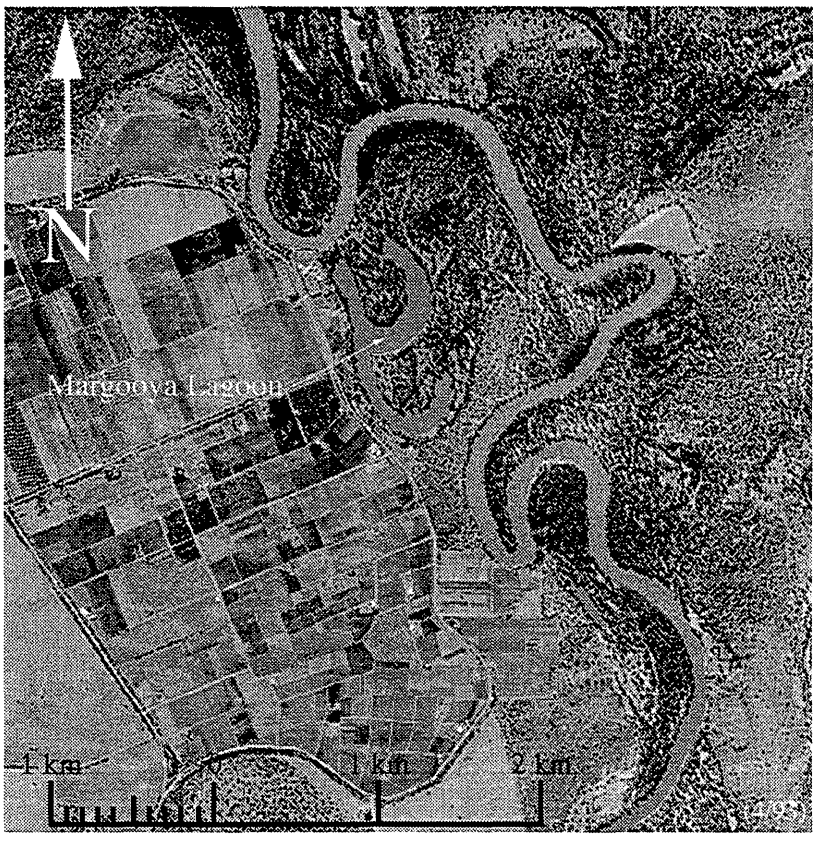
<Ranking of sustainability>

References Cited

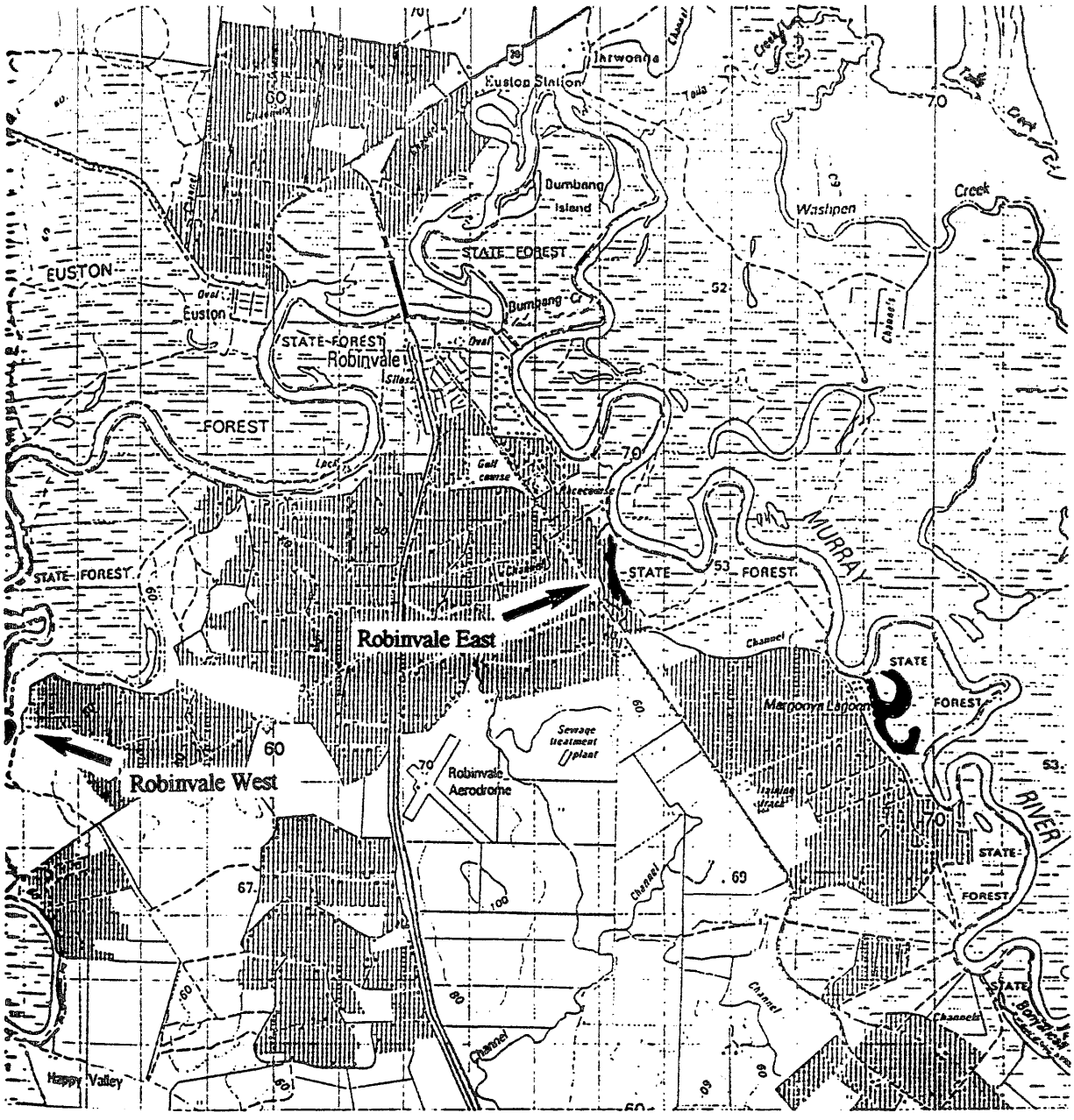
Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
Marfooya Lagoon
1 km
0
1 km
2 km

Robinvale Area



after (Hoxley, 1991, TN1)

<Site Name> Martin
<Synonyms>

Spatial

<Location description>

<Located in Murray Trench> Yes

<Location 1:250 000>

<Location 1:100 000>

<Zone>

<Coordinates easting (AMG)>

<Coordinates northing (AMG)>

<State> Victoria

General

<Year begun operation>

<Active/inactive>

<Full surface area (ha)> 0.25 ha

<Volume capacity (ML)>

<Full surface level (m AHD)>

<Groundwater level (m AHD)>

<Groundwater seepage/discharge>

<Average annual evaporation>

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)> 700 mg/L (RWC, 1993a)

<Sources of water to be disposed> Irrigation discharge

<Terminal/throughflow basin>

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> Martin
<Synonyms>

Engineering/Admin

<Public or private operation> Public

<Agency responsible>

<Project name> Martin

<Natural, modified natural or constructed>

<Modification type and degree>

Geological

<Site description and Geomorphology>

<Subsurface investigations at site>

<Structural setting>

<Stratigraphic setting>

<Host formation>

<Host lithofacies>

<Aquitard>

<Aquitard lithofacies>

<Aquifer>

<Aquifer lithofacies>

<Comments>

Summary of Hydrodynamics

<Distance to Murray or tributary>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer>

<kv of artificial floor>

<Site Name> Martin
<Synonyms>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard>

<kv and kh of aquifer>

<EC of aquifer> 20,000 mg/L TDS (RWC, 1993a)

<Porosity of aquifer>

<Thickness of aquifer>

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer>

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

<Site Name> McEwans
<Synonyms>

Spatial

<**Location description**> 1.5 kilometres west of Nangiloc,Victoria and 4 kilometres south of Bullock Swamp

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 622400

<**Coordinates northing (AMG)**> 6184000

<**State**> Victoria

General

<**Year begun operation**> 1975

<**Active/inactive**> Active

<**Full surface area (ha)**> 6.0 ha

<**Volume capacity (ML)**> 160 ML

<**Full surface level (m AHD)**> 40 m AHD

<**Groundwater level (m AHD)**> 38-39 m AHD (See figure 7a)

<**Groundwater seepage/discharge**> Discharge

<**Average annual evaporation**> 1980 mm/yr at Red Cliffs A pan

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**> 2000 EC

<**Range of salinity in basin (EC)**> 123,300 EC

<**Sources of water to be disposed**> Tile drainage from Nangiloc North Group

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**> Surrounding land cleared for irrigation

<Site Name> McEwans
<Synonyms>

Engineering/Admin

<**Public or private operation**> Private

<**Agency responsible**> Landholder

<**Project name**> McEwans

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> Two roughly east west depressions joined by a north trending channel within the Woorinen dunes. The site appears to be an active salina depending on the height of the water table.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located within the Raak Trough (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (3-5 m) (and perhaps some Yamba Formation as well), and is underlain by the Rufus Formation, the Channel Sand, the Blanchetown Clay (30-35 m), the Parilla Sand, (65 m), the Bookpurnong Beds/Geera clay, the Murray Group Limestone, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red sands and silts

<**Aquitard**> Rufus Formation and the Blanchetown Clay

<**Aquitard lithofacies**> Rufus Formation: Silts and clays; Blanchetown Clay: Clay

<**Aquifer**> Channel Sand and Parilla Sand

<**Aquifer lithofacies**> Channel Sand: Medium to coarse sand; Parilla Sand: medium to coarse sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 2 kilometres

<**Head between basin and river/tributary**>

<Site Name> McEwans
<Synonyms>

<Direction of groundwater flow in regional aquifer> Northeast towards the river (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Rufus Formation: 7-10 metres; Blanchetown Clay: 30-35 metres

<kv and kh of aquifer> Channel Sand: Kh = 40 m/day (Linke, 1993)

<EC of aquifer> > 50,000 mg/L TDS

<Porosity of aquifer>

<Thickness of aquifer> Channel Sand: 3-4 metres; Parilla Sand: 65 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> McEwans Basin appears to be an active salina during periods of disuse, however when in use it leaks into the Channel Sand. The leakage may cause two potential problems. First, Budahazy and Thompson (1992) have shown that the perched watertable (within the Woorinen Formation and on top of the Rufus Formation) without disposal to be within 0-1 metre of the surface directly beneath the basin. With disposal the mound increases in size causing potential salinisation to an area about 500 metres around the basin. Second, water that seeps through the Rufus Formation will enter the Channel Sand aquifer which is in direct contact with the River Murray allowing saline water to discharge into the river.

<Hydraulic linkage to surface runoff> Surface runoff forms a perched aquifer within the Woorinen Formation.

<Category - hydraulic stability>

<Site Name> McEwans
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

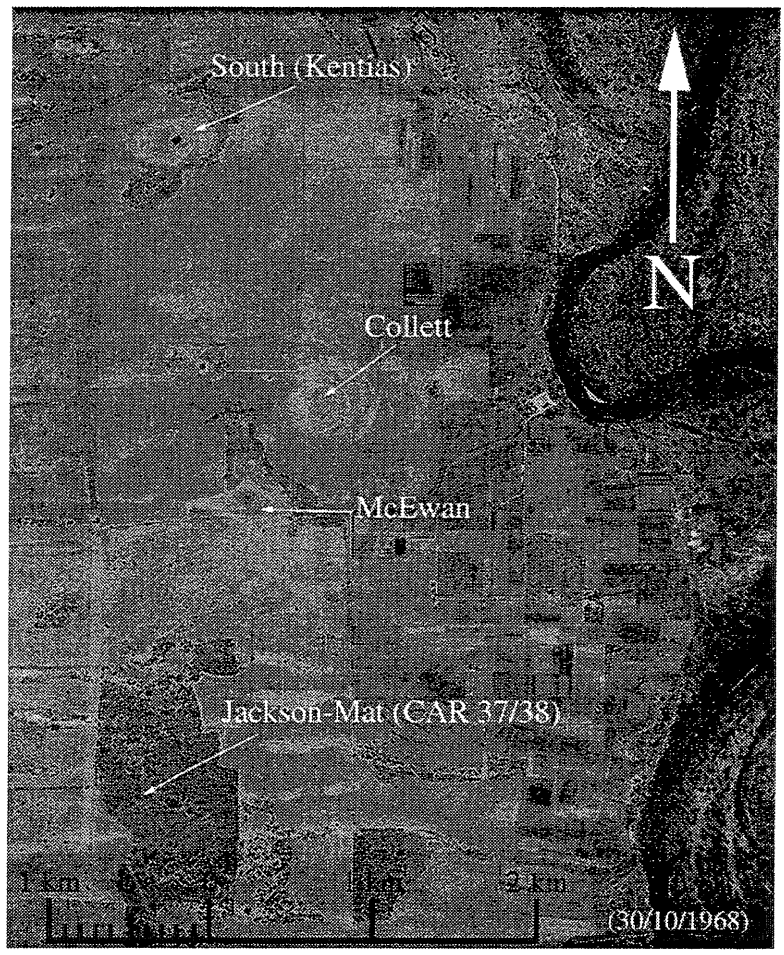
Budahazy, M., and Thompson, M., 1992- Nangiloc-Colignan Salinity Management Plan Investigation of basins for use as drainage disposal basins., Rural Water Corporation, Unpublished report 1992/15

Linke, G., 1994b- Nangiloc-Colignan McEwans, Kentia, and Colletts Basins - Evaporation capacity., Unpublished working file No. 02/00859

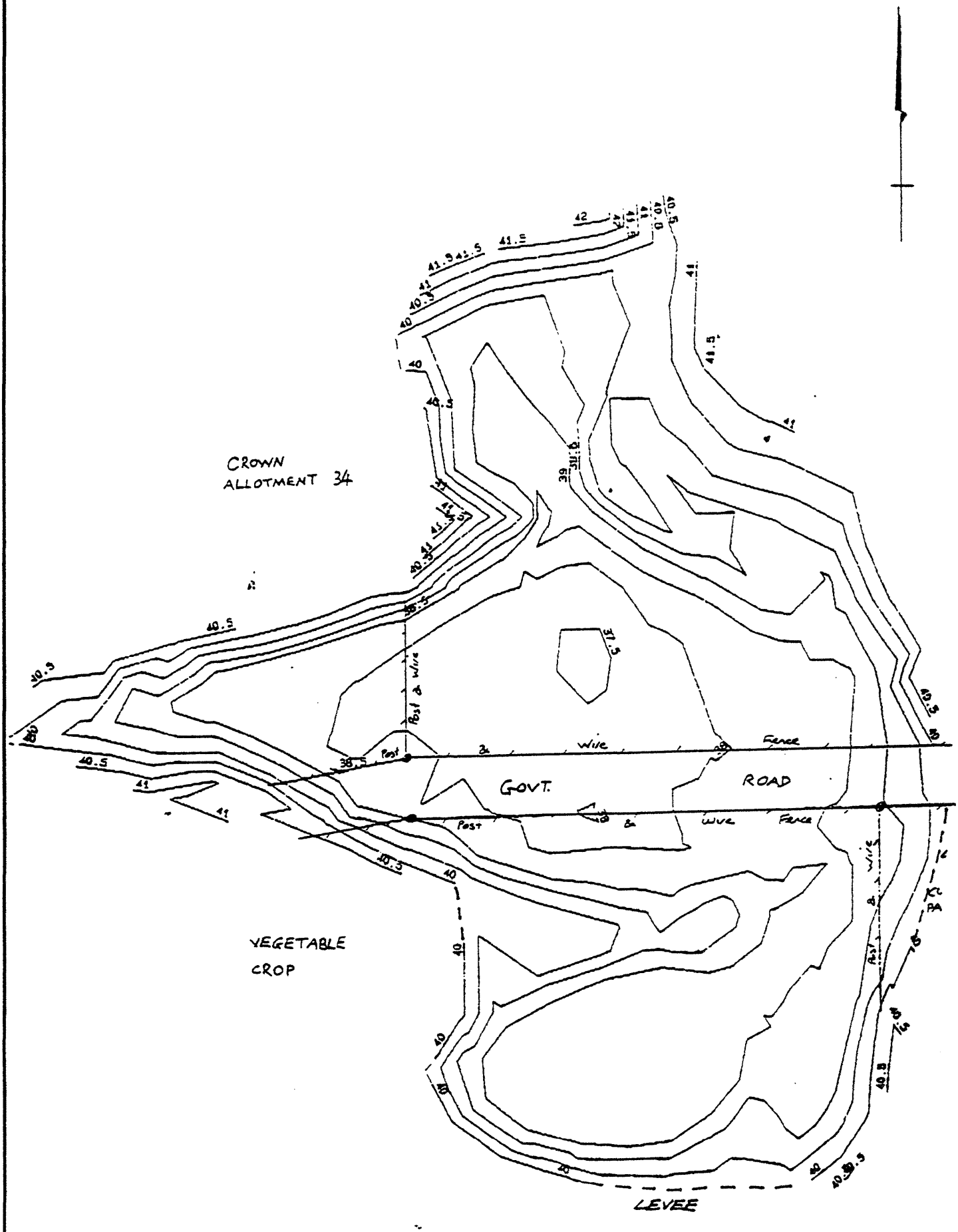
Linke, G., 1993- Nangiloc Colignan SMP - Drainage disposal to Karadoc Swamp - CMS Comps., Rural Water Corporation, Unpublished working file No. 93/01895

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.

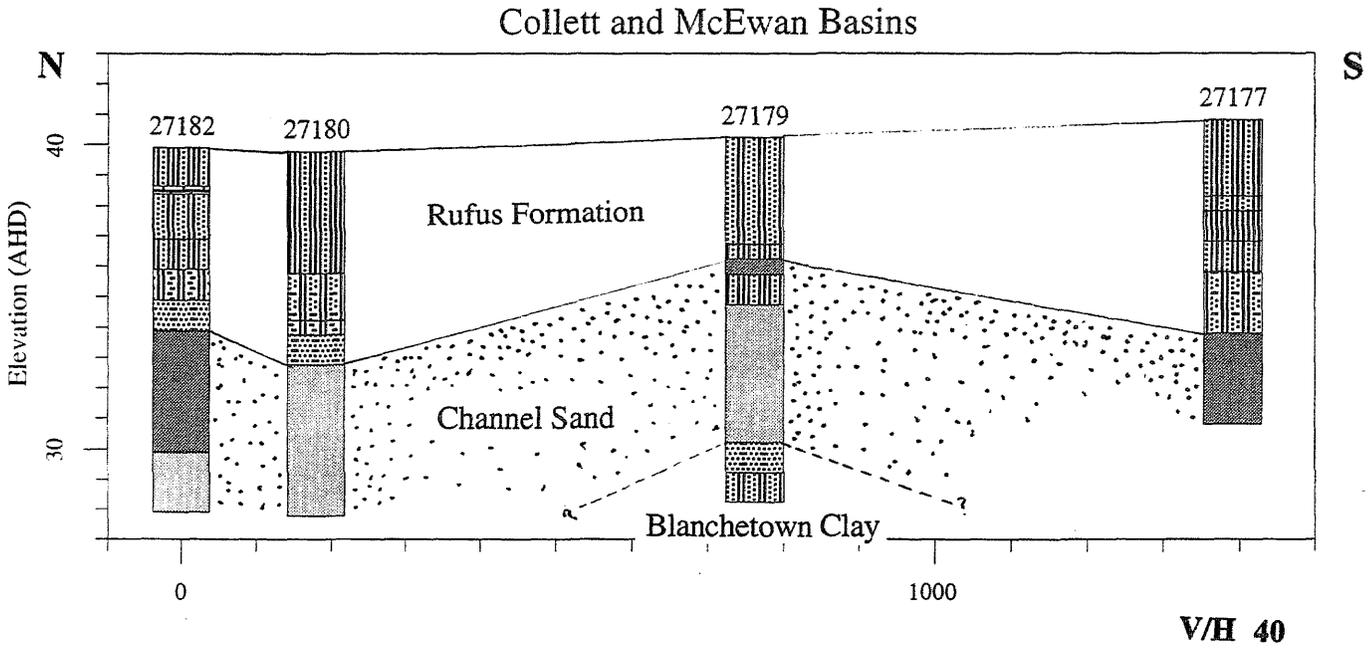

South (Kentia)
N
Collett
McEwan
Jackson-Mat (CAR 37/38)
1 km
1 km
2 km
(30/10/1968)

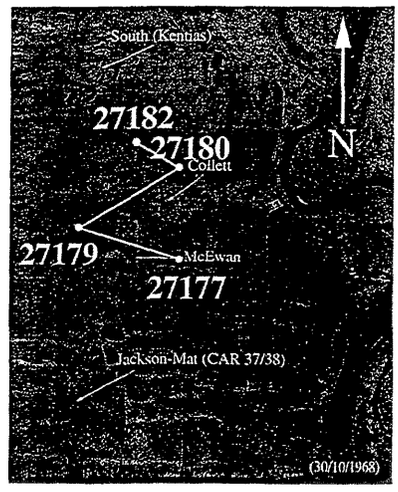
McEwans Basin



File D: 502000.PLT Reduced to A4 Point of interest 622337.856E 6184032.721N
Created on 18/07/1991 at 16:15:18 using GEOCOMP

(Budahazy and Thompson, 1992)


Collett and McEwan Basins
N
S
27182
27180
27179
27177
Rufus Formation
Channel Sand
Blanchetown Clay
Elevation (AHD)
40
30
0
1000
V/H 40


South (Kentinas)
27182
27180
Collett
N
27179
McEwan
27177
Jackson-Mat (CAR 37/38)
(30/10/1968)

<Site Name> Mercer Street
<Synonyms>

Spatial

<Location description> 10 kilometres WNW of Red Cliffs, Victoria and 15 kilometres SW of Mildura, Victoria

<Located in Murray Trench> No

<Location 1:250 000> Mildura

<Location 1:100 000> Mildura 7329

<Zone> 54

<Coordinates easting (AMG)> 599000

<Coordinates northing (AMG)> 6205000

<State> Victoria

General

<Year begun operation>

<Active/inactive> Active

<Full surface area (ha)>

<Volume capacity (ML)>

<Full surface level (m AHD)>

<Groundwater level (m AHD)> 38 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<Groundwater seepage/discharge> Discharge

<Average annual evaporation> 1980 mm/yr Class A pan Red Cliffs

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)> 114,300 mg/L TDS

<Sources of water to be disposed> Groundwater discharge

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> Mercer Street
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> First Mildura Irrigation Trust (FMIT)

<**Project name**> Mercer Street

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is a low lying area (deflation basin?) below the level of the Woorinen Formation dunes. There is a lunette on the northwestern margin of the basin associated with Koorlong basin (FMIT 5) and evidence of saline discharge along the basin's margin. It is surrounded by cropland and semi-cleared mallee.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located on the Wargan Fault, southeast of the Danyo Fault and northwest of the Red Cliffs Ridge (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (1-2 m), and is underlain by the Blanchetown Clay (20 m), the Parilla Sand (50 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay and silty clay; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 16 kilometres

<Site Name> Mercer Street
<Synonyms>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Southwest away from the Murray River (RWC, 1991).

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Blanchetown Clay: 20 metres; Upper Parilla Sand: 5-7 metres

<kv and kh of aquifer> Parilla Sand: Kh = 1 m/day (Linke, 1990b)

<EC of aquifer> > 50,000 mg/L TDS (RWC, 1993a)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 45 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin receives groundwater discharge from either the Parilla Sand, the Woorinen Formation (perched aquifer), or a combination of the two. The high salinity of the basin (114,300 mg/L TDS) suggests that the discharge is from the Parilla Sand (50,000 mg/L TDS). A possible discharge source from the Parilla Sand is also supported because the basin has been the site of deflation and discharge in the past (which has eroded through the Woorinen Formation). Also, because the basin is located above the Wargan Fault, the permeability of the Blanchetown Clay and Upper Parilla Sand may be fracture enhanced allowing the groundwater in the Parilla (which is at artesian pressure) a route to the surface.

The water in the perched watertable is mostly from irrigation accession and is thus quite fresh (2000-30000 EC), which would necessitate large volumes of water to raise the salinity of the basin. In addition, the basin is not bounded by the Woorinen dunes to the northeast (the direction of flow is northeast to southeast) so there may be no discharge . The most likely scenario is that most of the discharge comes from the Parilla Sand although the basin may receive some water from the perched aquifer. This is because of the high salinities of the basin, the level of water in the basin (half full), the high potential of the Parilla Sand, and the location of the basin over the Wargan Fault.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> Mercer Street
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

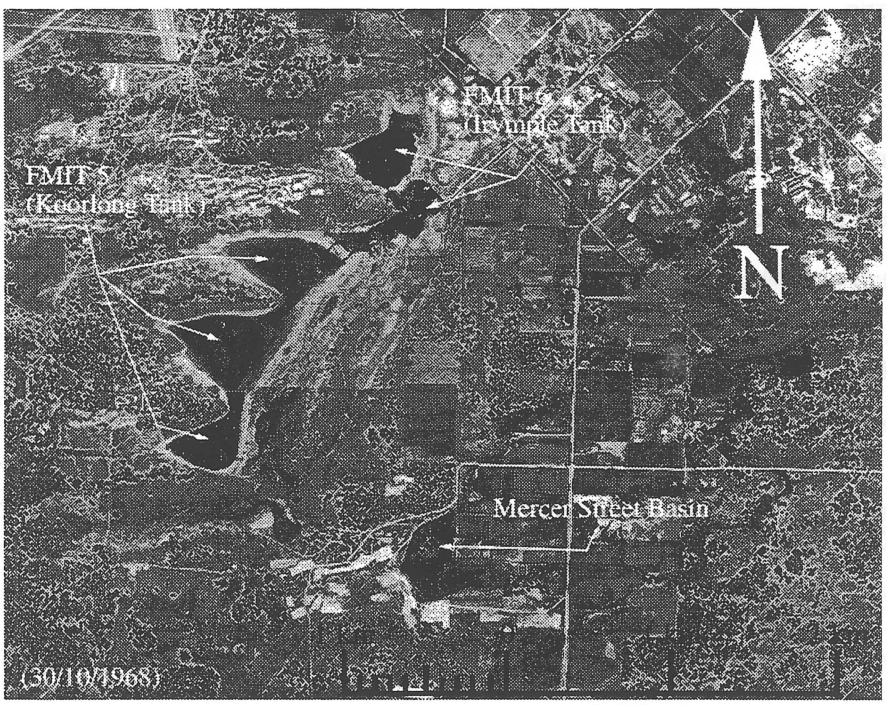
References Cited

Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


FMIT 6
(Irvmple Tank)
FMIT 5
(Koorlong Tank)
N
Mercer Street Basin
(30/10/1968)

<Site Name> Mincha West
<Synonyms>

Spatial

<**Location description**> Allotment 19, Mincha West owned by Hugh McKinnon

<**Located in Murray Trench**> No

<**Location 1:250 000**> Deniliquin

<**Location 1:100 000**> Cohuna 7726

<**Zone**> 55

<**Coordinates easting (AMG)**> 233255

<**Coordinates northing (AMG)**> 6013703

<**State**> Victoria

General

<**Year begun operation**> 1990

<**Active/inactive**> Inactive

<**Full surface area (ha)**> 2 ha (RWC, 1993a); 8.4 ha with 1 ha crystallisation basin (McConachy, 1991)

<**Volume capacity (ML)**> 5 ML

<**Full surface level (m AHD)**> Minimum level 86.81 m AHD, Maximum level 87.23 m AHD (McConachy, 1991)

<**Groundwater level (m AHD)**> In summer water level is 1-1.5 metre below surface and in winter water level is 0-1 metre below surface (McConachy, 1991)

<**Groundwater seepage/discharge**> Discharge

<**Average annual evaporation**> Inflow/evaporation > 1.5; Pan factor 0.86 (McConachy, 1991)

<**Volume disposed annually (ML/yr)**> 74 ML/yr

<**Salinity of water disposed (EC)**> 55,000 EC

<**Range of salinity in basin (EC)**> 50,000-120,000 EC

<**Sources of water to be disposed**> Groundwater pump

<**Terminal/throughflow basin**> Throughflow

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> Kaoline

<**Review of environmental impacts**> Basin effectively lowered water table in the surrounding area.

<Site Name> Mincha West
<Synonyms>

Engineering/Admin

<**Public or private operation**> Private

<**Agency responsible**> Rural Water Corporation

<**Project name**> Mincha West

<**Natural, modified natural or constructed**> Constructed

<**Modification type and degree**> Inlet/outlet, artificial floor, and interceptor bores around basin to capture leakage.

Geological

<**Site description and Geomorphology**> The basin is located between Calivil and Sevens Creek surrounded by flat farm land.

<**Subsurface investigations at site**> RWC bores 36419-36435

<**Structural setting**> The basin is located east of the Cadell fault on a Shepparton Formation terrace (Lawrence and Macumber, 1974).

<**Stratigraphic setting**> The basin is underlain by the Shepparton Formation (80-85 m) (Geology interpreted from Williams and Woolley, 1992).

<**Host formation**> Shepparton Formation

<**Host lithofacies**> Clays and silts; soil type Fernihurst clay loam (McConachy, 1991)

<**Aquitard**> Shepparton Formation

<**Aquitard lithofacies**> Clays and silts; soil type Fernihurst clay loam (McConachy, 1991)

<**Aquifer**> Shepparton Formation

<**Aquifer lithofacies**> Shoestring sand bodies within the Shepparton Formation

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 1.5 kilometres to Calivil Creek

<**Head between basin and river/tributary**>

<Site Name> Mincha West
<Synonyms>

<Direction of groundwater flow in regional aquifer> North towards the Murray River (Williams and Woolley, 1992)

<kv of artificial floor>

<kv and kh of host> Shepparton Formation: Kv = 0.06 to 0.28 m/day average of 0.18 m/day at a depth of 1.8 to 2.5 metres (McConachy, 1991)

<kv and kh of aquitard> Shepparton Formation: Kv = 0.06 to 0.28 m/day average of 0.18 m/day at a depth of 1.8 to 2.5 metres (McConachy, 1991)

<Thickness of aquitard> ~80-85 metres

<kv and kh of aquifer>

<EC of aquifer> > 50,000 mg/L TDS (RWC, 1993a); Shepparton Formation salinity: 38,000 to 53,000 EC average 48,000 EC (McConachy, 1991)

<Porosity of aquifer>

<Thickness of aquifer> Variable depending on geometry of shoestring sand bodies

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin is estimated to leak at a rate of 1 mm/day/ha (30.5 ML/yr or ~40% of input) through the kaoline lining and into the Shepparton Formation. This water is caught by the recirculating pumps and lifted back into the basin. The current basin size is too small for the amount of water being pumped into it, however it has been successful in lowering the local watertable (McConachy, 1991). The Shepparton Formation is the only aquifer in the area and is recharged from the highland to the south of the basin, which in the absence of the tile drainage and interceptor pumps must be near or at the land surface. Leakage from the basin laterally should be controlled by the interceptor pumps, however leakage downwards (potentially into a sand body) is not stopped, but potential contamination is low.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation> The basin is thought to leak at 30.5 ML/yr or about 40% of input (McConachy, 1991)

<Site Name> Mincha West
<Synonyms>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

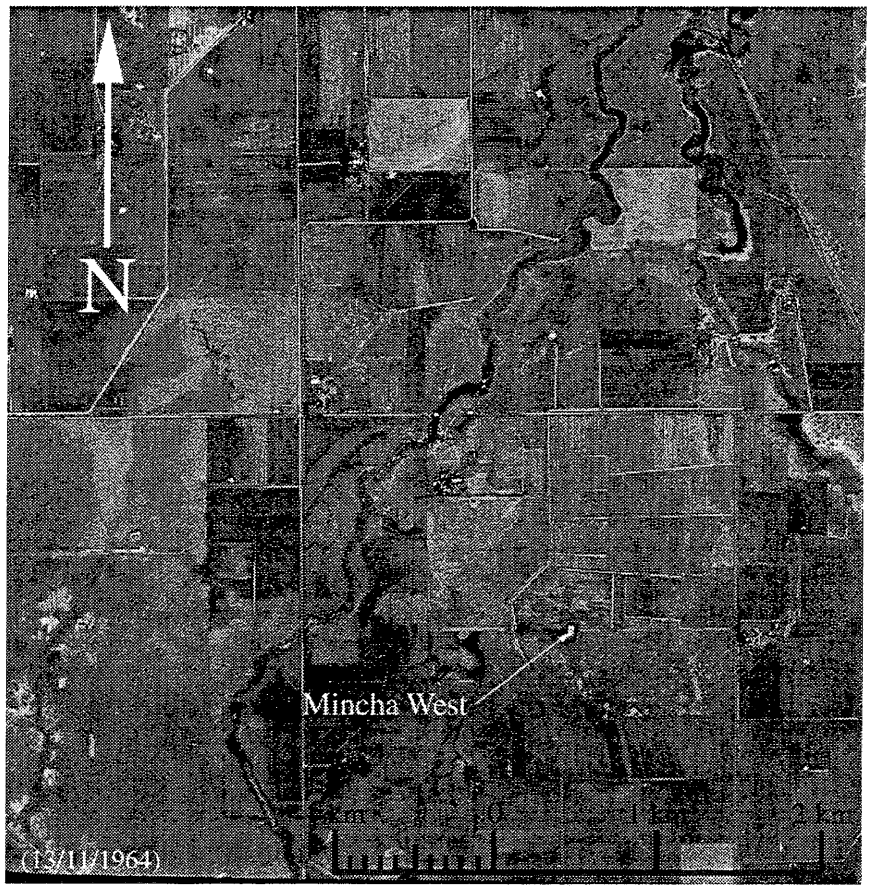
References Cited

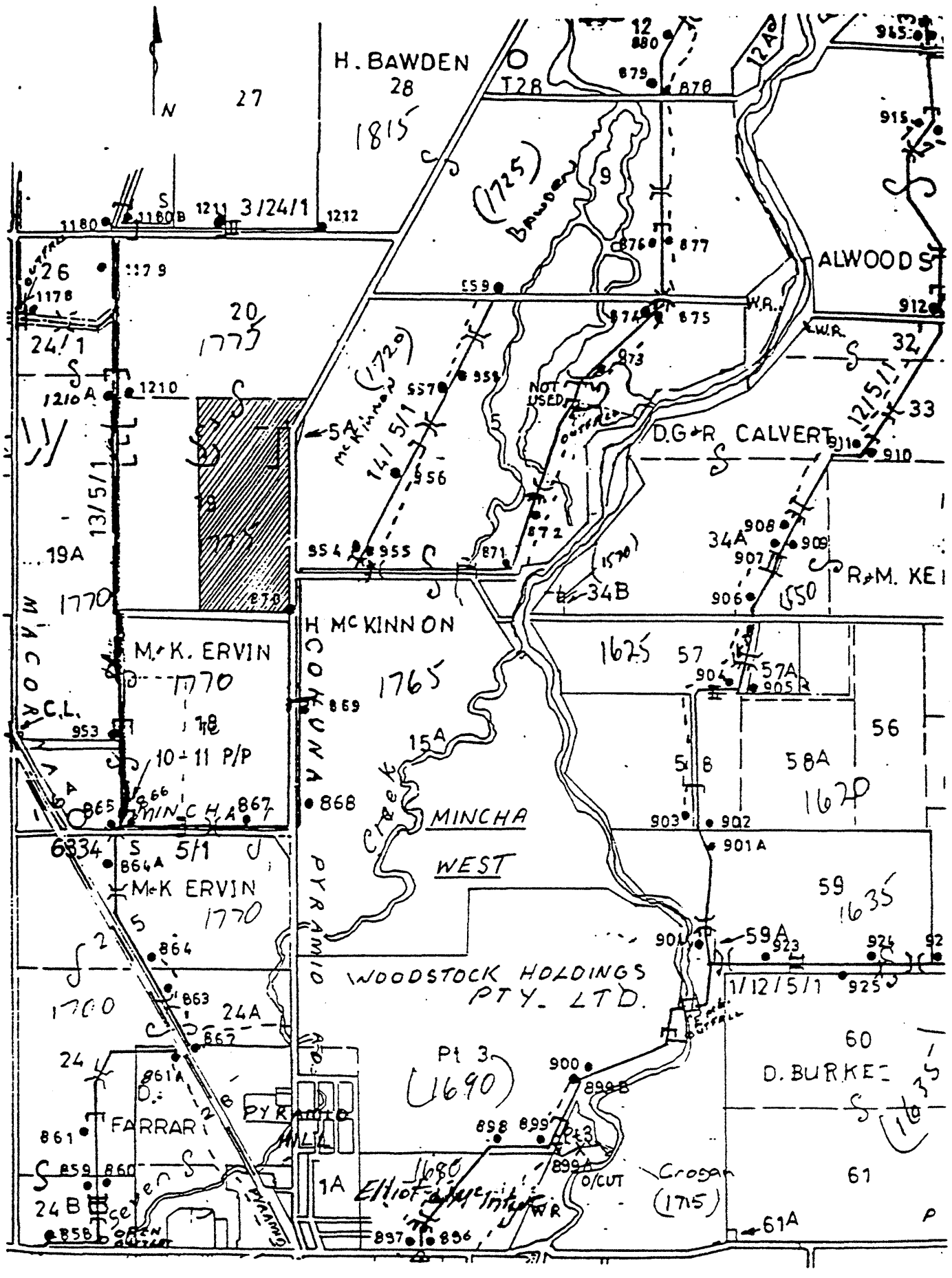
Lawrence, C.R., and Macumber, P.G., 1974- Swan Hill Geological Map (1:250,000 scale)., Geological Survey of Victoria

McConachy, F., 1991- Design of an evaporation basin and tile drainage demonstration site on the Tragowel Plains., Rural Water Corporation, Unpublished report

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

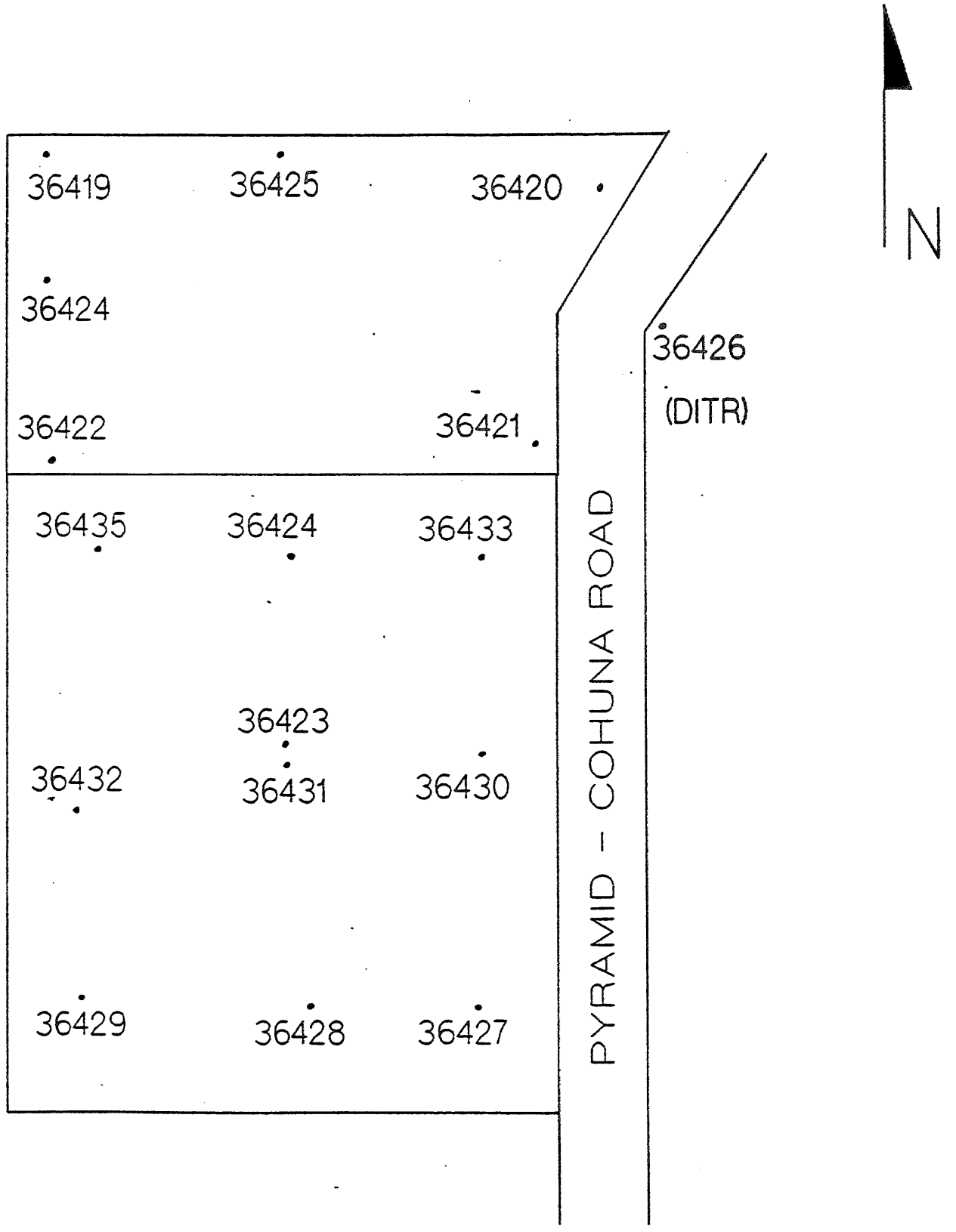
Williams, R.M. and Woolley, D. Department of Water Resources, 1992- Deniliquin Hydrogeological Map (1:250 000 scale), Australian Geological Survey Organisation, Canberra, Australia


N
Mincha West
0 1 km 2 km
(13/11/1964)



H. McKinnon — CA19, Parish of Mincha West

(McConachy, 1991)



H. McKinnon — CA19, Parish of Mincha West
Location of bores

(McConachy, 1991)

<Site Name> Mineral Reserve Basin
<Synonyms>

Spatial

<**Location description**> 7 kilometres SSW of Lake Boga and 5 kilometres WSW of Tresco, Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Swan Hill

<**Location 1:100 000**> Kerang 7626

<**Zone**> 54

<**Coordinates easting (AMG)**> 737500

<**Coordinates northing (AMG)**> 6064800

<**State**> Victoria

General

<**Year begun operation**> Proposal only, never built

<**Active/inactive**> Inactive

<**Full surface area (ha)**>

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> Basin 1: 71 m AHD, Basin 2: 70 m AHD; Basin 3: 70 m AHD

<**Groundwater level (m AHD)**> 68 m AHD

<**Groundwater seepage/discharge**> Seepage; 0.16 ML/day at present

<**Average annual evaporation**> 1500 mm/yr

<**Volume disposed annually (ML/yr)**> Designed for 4500 ML/yr

<**Salinity of water disposed (EC)**> Initially 70,000 EC (from Lake Tutchewop) reducing to 12,000 EC

<**Range of salinity in basin (EC)**> 50,000 EC

<**Sources of water to be disposed**> Tresco Irrigation District and Mystic Park Irrigation District

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**>

<**Review of environmental impacts**> The basin would cease to operate as groundwater discharge as present scheme would be a constant recharge to aquifer

<Site Name> Mineral Reserve Basin
<Synonyms>

Engineering/Admin

<Public or private operation>

<Agency responsible>

<Project name> Mineral Reserve Basin

<Natural, modified natural or constructed> Modified natural

<Modification type and degree>

Geological

<Site description and Geomorphology> The basin lies on the western margin of the Avoca floodplain and consists of gently undulating plains and low dunes, with numerous lakes and lunettes. The basin has been a discharge basin in the past and is bounded on the east by a lunette and on the west by fine aeolian sand.

<Subsurface investigations at site>

<Structural setting> The basin is east of the Tresco Ridge and west of the Canine Ridge (Coffey and Partners Pty., 1982).

<Stratigraphic setting> The basin is floored by the Yamba Formation (3-5 m), and underlain by the Woorinen Formation (2 m), the Shepparton Formation (0-25 m) the Parilla Sand (23 m), and the Renmark Group (Geology interpreted from Pratt, 1988).

<Host formation> Yamba Formation

<Host lithofacies> Clays, silts, and lunettes

<Aquitard> Shepparton Formation and Lake Boga Granite

<Aquitard lithofacies> Shepparton Formation: Silty clays, commonly fissure and with lateritic weathering, Boga Granite: Granite

<Aquifer> Shepparton Formation (A1 and A2) and Parilla Sand

<Aquifer lithofacies> Shepparton Formation: Locally developed sand bodies beneath basins 1 and 3, with two lenses present (A1 and A2); Parilla Sand: Fine to medium sand

<Comments>

Summary of Hydrodynamics

<Distance to Murray or tributary> 14 kilometres

<Head between basin and river/tributary>

<Site Name> Mineral Reserve Basin
<Synonyms>

<Direction of groundwater flow in regional aquifer> Northwest towards Lake Tyrrell (O'Rourke, 1992)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard> Shepparton Formation: Kv =2.6 x 10^{-2} to 4.3 x 10^{-3} m/day (Coffey and Partners Pty, 1982)

<Thickness of aquitard> Shepparton Formation: 0-25 metres

<kv and kh of aquifer> Shepparton Formation: 11 m/day; Parilla Sand: 2 m/day (Ife, 1985)

<EC of aquifer> Parilla Sand: 50,000 to 129,899 EC (Coffey and Partners Pty, 1982)

<Porosity of aquifer>

<Thickness of aquifer> Shepparton Formation: Variable depending o presence of sand bodies, Parilla Sand: 25 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface> Basin acted as a discharge basin during periods of high groundwater.

Interpretive 1

<Hydraulic linkage to regional aquifer> If disposal had occurred in the basin, the full level would have been sufficient to allow seepage from the basin. The disposal water would enter the Parilla Sand regional aquifer and under pressure flow (driven partially by the irrigation mound beneath Tresco) to the west and into Lake Tyrrell. Groundwater flow within the Shepparton Formation could act to raise the local water table, however the effects would be localised due to the presence of high permeability prior streams.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Site Name> Mineral Reserve Basin
<Synonyms>

<Evaporation surplus> 1200 mm/yr (Evaporation 1500 mm/yr and precipitation 300 mm/yr)

Interpretive 2

<Ranking of sustainability>

References Cited

Coffey and Partners Pty Ltd, 1982- Hydrogeological study of the Mineral Reserve Basin Scheme., for State Rivers and Water Supply Commission, Report H81/1-AA

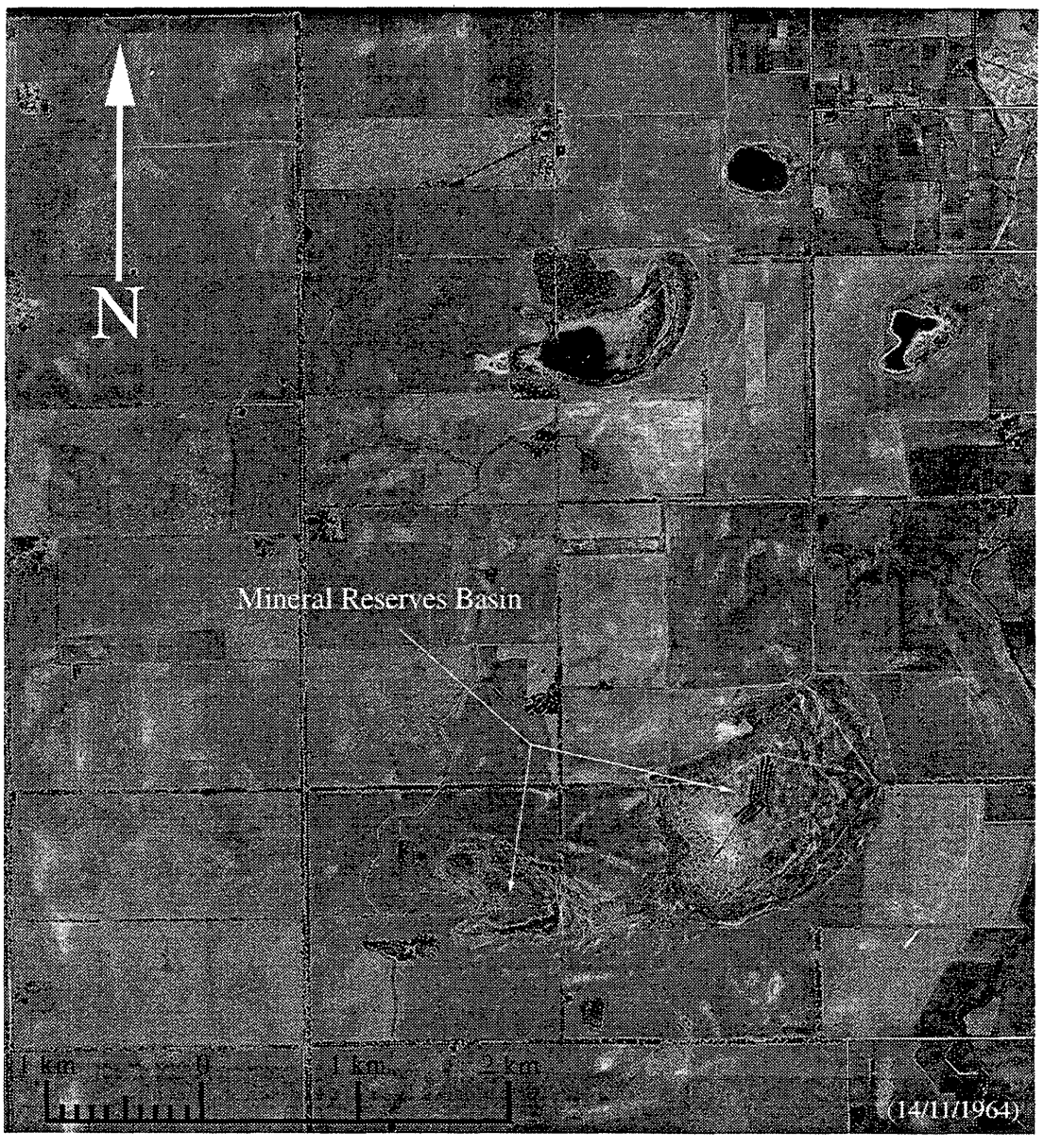
Ife, D., 1985- Hydrogeology of the Mineral Reserve Basins., Rural Water Commission, Unpublished report.

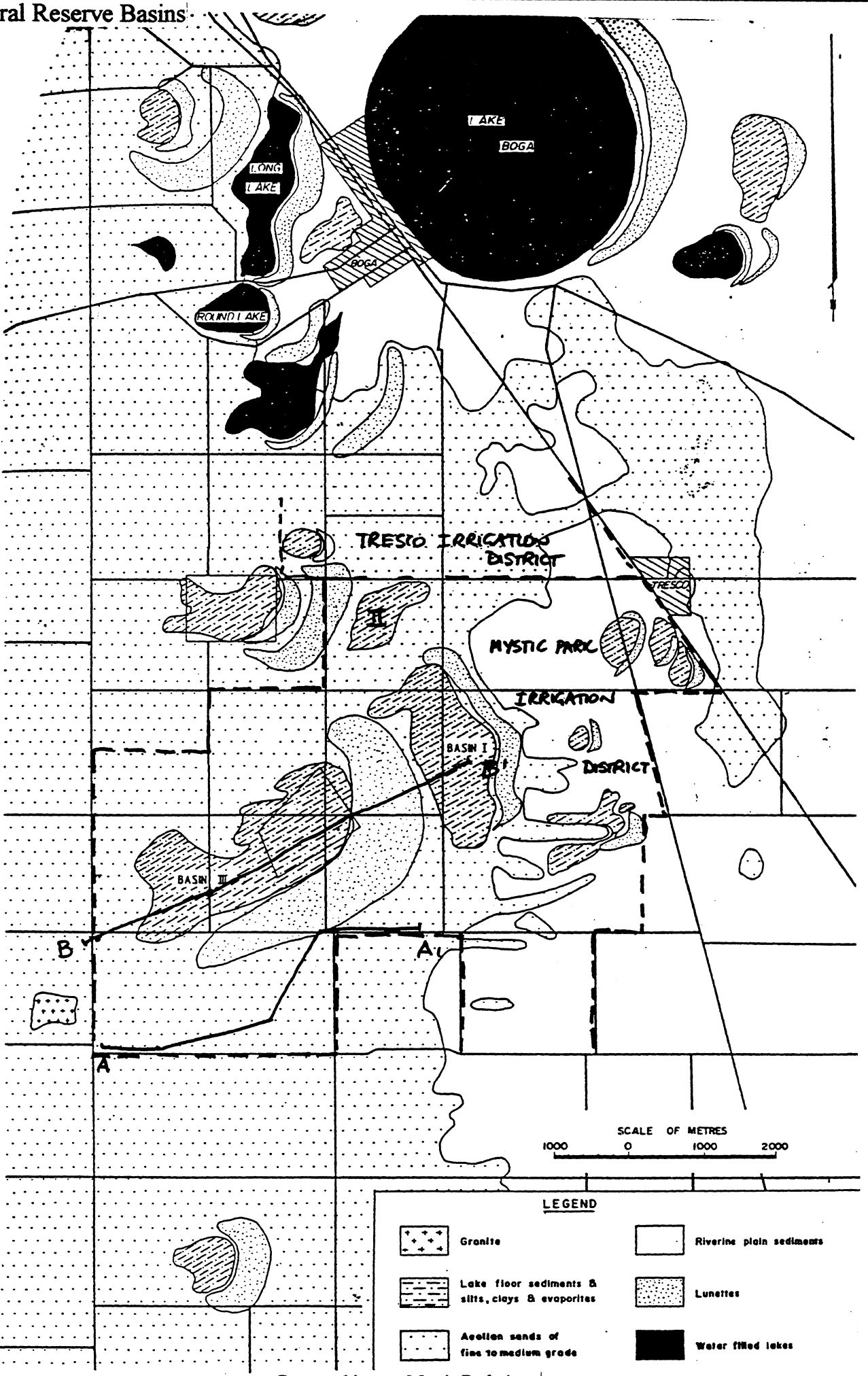
Lawrence, C.R., and Macumber, P.G., 1974- Swan Hill Geological Map (1:250,000 scale)., Geological Survey of Victoria

O'Rourke, M.E., et. al, Victorian Rural Water Commission, 1992- Swan Hill Hydrogeological Map (1:250,000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra Australia

Pratt, M.C., 1988- Hydrogeological assessment of the Loddon and Avoca Plains., Department of Water Resources, Victoria, Unpublished report

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.


N
Mineral Reserves Basin
1 km
0
1 km
2 km
(14/11/1964)



Geomorphic map Mystic Park Area

(Ife, 1985)

<Site Name> Nangiloc-Colignan 34
<Synonyms>

Spatial

<Location description> 6.5 kilometres WSW of Colignan, Victoria and 1 kilometre SE of Colignan Basin

<Located in Murray Trench> Yes

<Location 1:250 000> Mildura

<Location 1:100 000> Nowingi 7328

<Zone> 54

<Coordinates easting (AMG)> 619700

<Coordinates northing (AMG)> 6177100

<State> Victoria

General

<Year begun operation>

<Active/inactive> Active

<Full surface area (ha)> 40 ha

<Volume capacity (ML)>

<Full surface level (m AHD)>

<Groundwater level (m AHD)>

<Groundwater seepage/discharge>

<Average annual evaporation> Inflow/evaporation = 0.9

<Volume disposed annually (ML/yr)> 430 ML/yr

<Salinity of water disposed (EC)> 2000 EC

<Range of salinity in basin (EC)>

<Sources of water to be disposed> Tile Drains

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> Nangiloc-Colignan 34
<Synonyms>

Engineering/Admin

<**Public or private operation**> Private

<**Agency responsible**>Landholder

<**Project name**> Nangiloc-Colignan 34

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> Nangiloc-Colignan 34 is a small basin southeast of Colignan Basin located within the trench on the Rufus Terrace. It is in a depression within the longitudinal, east-west trending Woorinen dunes. The mallee around the site has been cleared for agriculture and the there appears to be evidence of deflation (a lunette?) on the eastern margin of the basin.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located within the Raak Trough (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (perhaps some Yamba Formation as well) (5 m), and is underlain by the Rufus Formation (7-10 m), the Channel Sands (Monoman Formation) (5-10 m), the Blanchetown Clay (30 m), the Parilla Sand (65 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Rufus Formation and Blanchetown Clay

<**Aquitard lithofacies**> Rufus Formation: Silt and silt clay; Blanchetown Clay: Clay

<**Aquifer**> Channel Sand and Parilla Sand

<**Aquifer lithofacies**> Channel Sand and Parilla Sand: Medium to coarse sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 8 kilometres

<Site Name> Nangiloc-Colignan 34
<Synonyms>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> WNW away from the river (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard> Rufus Formation: Several order of magnitude less than Channel Sand (Linke, 1990b)

<Thickness of aquitard> Rufus Formation: 7-10 metres; Blanchetown Clay: 25-30 metres

<kv and kh of aquifer> Channel Sand: Kh = 40 m/day (Linke, 1993)

<EC of aquifer> > 50,000 mg/L TDS

<Porosity of aquifer>

<Thickness of aquifer> Channel Sand: 10 m; Parilla Sand: 65 metres

<kv and kh of alluvial aquifer> Channel Sand: Kh = 40 m/day (Linke, 1993)

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> There should be little or no leakage from the basin into the Channel Sand aquifer for the following reasons. First, even with disposal the potentiometric surface of the Channel Sand is higher than full level of the basin. Second, the Rufus Formation is a reasonably good aquitard with groundwater accessions into the Channel Sand estimated to be 0.4 ML/yr/ha (Linke, 1990b). Lastly, the amount of disposal is less than or equal to the amount of disposal (1980 mm/yr evaporation equals 784 ML/yr at 40 ha). Problems may be encountered in the perched aquifer in the Woorinen Formation where disposal could raise the local watertable causing potential salinisation of low lying areas.

<Hydraulic linkage to surface runoff> Surface runoff enters the perched watertable.

<Category - hydraulic stability>

<Site Name> Nangiloc-Colignan 34
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Linke, G., 1993- Nangiloc Colignan SMP - Drainage disposal to Karadoc Swamp - CMS Comps., Rural Water Corporation, Unpublished working file No. 93/01895

Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


Boonbonar Basins
Nangiloc-Colignan 34
N
1 km
1 km
2 km
(30/10/1968)

<Site Name> Nyah
<Synonyms>

Spatial

<Location description> 3.5 kilometres SSE of Nyah West, Victoria and 12 kilometres NW of Woorinen, Victoria

<Located in Murray Trench> No

<Location 1:250 000> Swan Hill

<Location 1:100 000> Nyah 7527

<Zone> 54

<Coordinates easting (AMG)> 714200

<Coordinates northing (AMG)> 6100300

<State> Victoria

General

<Year begun operation>

<Active/inactive> Active

<Full surface area (ha)> 7 ha

<Volume capacity (ML)> 70 ML

<Full surface level (m AHD)>

<Groundwater level (m AHD)> 58-60 m AHD (O'Rourke, 1992)

<Groundwater seepage/discharge> Seepage

<Average annual evaporation>

<Volume disposed annually (ML/yr)> None

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)> Dry

<Sources of water to be disposed> Nyah Irrigation Area

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts> Basin holds water very rarely, twice in twenty years. It is presently under cultivation.

<Site Name> Nyah
<Synonyms>

Engineering/Admin

<**Public or private operation**> Private

<**Agency responsible**>

<**Project name**> Nyah Irrigation Area

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is located in a depression amidst (but not controlled by) Woorinen Formation dunes. It is surrounded by farmland and is itself currently under cultivation.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is east of the Nyah Ridge, west of the Leaghur Fault, and east of the Yarraby Ridges (Parilla Strandlines) (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (3-10 m) and underlain by the Shepparton Formation (2-5 m), the Parilla Sand (50-60 m), and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sands

<**Aquitard**> Shepparton Formation

<**Aquitard lithofacies**> Clay and silt

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 4 kilometres

<**Head between basin and river/tributary**>

<Site Name> Nyah
<Synonyms>

<Direction of groundwater flow in regional aquifer> West away from the Murray River and towards Lake Wahpool/Lake Timboram (O'Rourke, 1992)

<kv of artificial floor>

<kv and kh of host> Kh: 20-40 m/day (Transmissivity 190 m^2/day SR&WSC, 1974)

<kv and kh of aquitard>

<Thickness of aquitard> 2-5 metres

<kv and kh of aquifer>

<EC of aquifer> 14,000 to 35,000 EC (O'Rourke, 1992)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 50-60 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin has the capacity to leak into the Parilla Sand aquifer due the high full level of the basin (~70 m AHD) and the low potentiometric surface of the Parilla (58 m AHD). The Shepparton Formation is thin in the area and the basin occupies a particularly low point in the landscape suggesting that there is little separation between the basin and the aquifer. Historically, the basin has only held water twice and is now being used for farming so it is difficult to ascertain the effects on long term disposal. Water that does enter the Parilla Sand would flow westwards and discharge at Lake Wahpool/Lake Timboram, causing relatively little damage.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Site Name> Nyah
<Synonyms>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

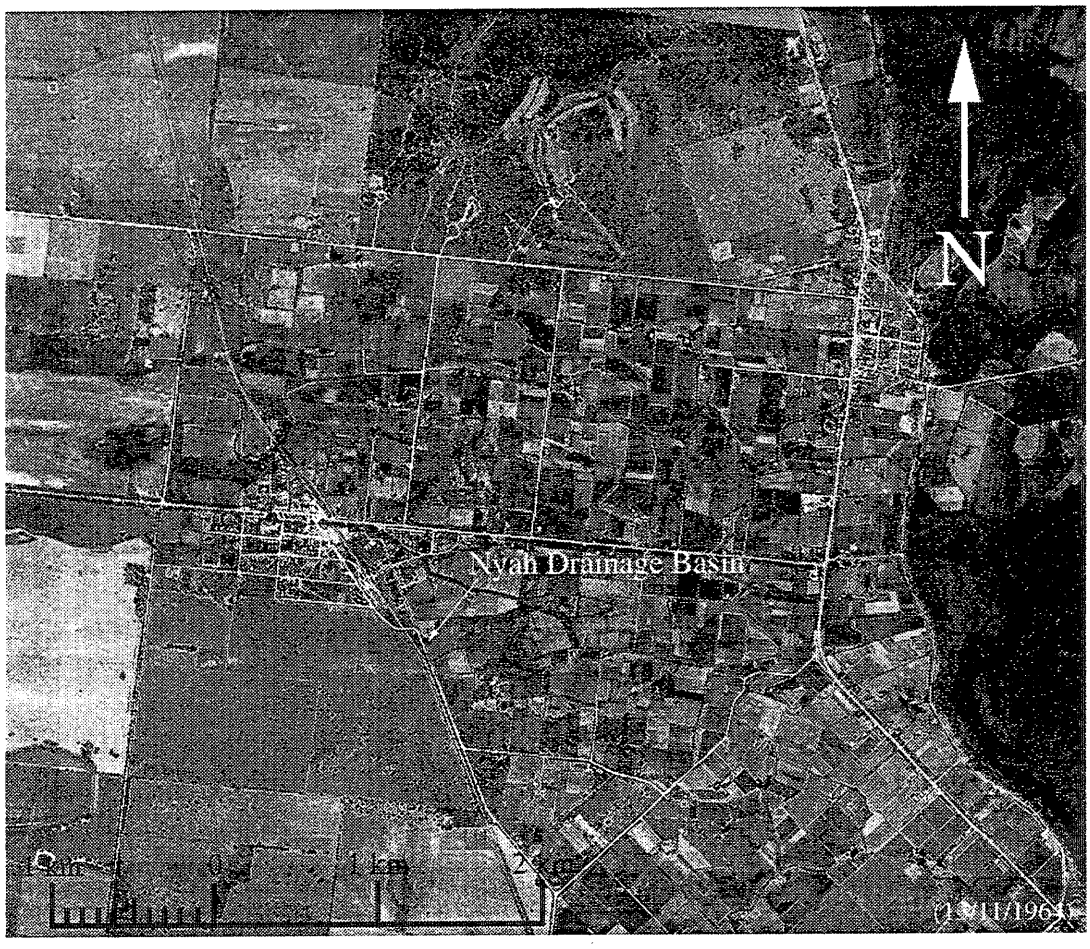
References Cited

O'Rourke, M.E., et. al, Victorian Rural Water Commission, 1992- Swan Hill Hydrogeological Map (1:250,000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra Australia

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

State Rivers and Water Supply Commission, Victoria (SR&WSC), 1974- Sunraysia Salinity Investigations., Unpublished report

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
Nyah Drainage Basin
1 km
0
1 km
2 km

<Site Name> Old Dam
<Synonyms>

Spatial

<Location description> 3.5 kilometres SW of Colignan, Victoria and 11.5 kilometres ENE of Nowingi, Victoria

<Located in Murray Trench> Yes

<Location 1:250 000> Mildura

<Location 1:100 000> Nowingi 7328

<Zone> 54

<Coordinates easting (AMG)> 622800

<Coordinates northing (AMG)> 6175500

<State> Victoria

General

<Year begun operation>

<Active/inactive> Active

<Full surface area (ha)> 5 ha

<Volume capacity (ML)>

<Full surface level (m AHD)> at least >40 m AHD

<Groundwater level (m AHD)> Channel Sand: ~39.3 m AHD; Parilla Sand: ~37.9 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<Groundwater seepage/discharge> Seepage

<Average annual evaporation> 1980 mm/yr Class A pan Red Cliffs

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)> >200,000 EC (off scale)

<Sources of water to be disposed> Tile Drains

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> Old Dam
<Synonyms>

Engineering/Admin

<**Public or private operation**> Private

<**Agency responsible**> Landholder

<**Project name**> Old Dam

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The site appears to have been used for water storage in the past. It is located within the Murray Trench and lies on the Rufus Terrace. It is built in a depression of the Woorinen Formation and is surrounded by cleared and uncleared mallee.

<**Subsurface investigations at site**>

<**Structural setting**> The basin lies within the Raak Trough (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (5-10 m), and is underlain by the Rufus Formation (3 m), the Channel Sand (Monoman Formation) (7 m), the Blanchetown Clay (32 m), the Parilla Sand (65 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Rufus Formation and Blanchetown Clay

<**Aquitard lithofacies**> Rufus Formation: Silt and silty clay; Blanchetown Clay: Clay and clayey silt

<**Aquifer**> Channel Sand and Parilla Sand

<**Aquifer lithofacies**> Channel Sand and Parilla Sand: Medium to coarse sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 3.5 kilometres

<Site Name> Old Dam
<Synonyms>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> SSW towards the Kulkyne Basins

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Rufus Formation: 3 metres; Blanchetown Clay: 32 metres

<kv and kh of aquifer> Rufus Formation: Kh = 40 m/day (Linke, 1993); Parilla Sand Kh = 1 m/day (Thorne, Hoxley, and Chaplin, 1990)

<EC of aquifer> > 50,000 mg/L TDS (RWC, 1993); Channel Sand: 40,000 EC. Parilla Sand: 20,000 EC (Thorne, Hoxley, and Chaplin, 1990)

<Porosity of aquifer>

<Thickness of aquifer> Channel Sand: 7 metres; Parilla Sand: 65 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin does have the potential to leak because its full level is at or above the Channel Sand potentiometric surface. The amount of leakage is controlled by the permeability of the Rufus Formation, which is estimated to leak at a rate of 0.4 ML/ha/yr (Linke, 1993). In this case it means that the total groundwater accession is about 2 ML/yr. The amount of available water to enter the Channel Sand is controlled by the evaporative capacity of the basin which is estimated to be 99 ML/yr (1980 mm/yr evaporation x 5 ha), while the inflow into the basin is 30 ML. The low evaporation excess is supported by the extremely high salinities in the basin (>200,000 EC) which results in little or no water to enter the aquifer. The water that does penetrate into the Channel Sand will be carried into the Kulkyne Basins, a regional discharge zone, by the irrigation mound under Colignan. Of more importance is saline groundwater flow into the perched aquifer of the Woorinen Formation leading to higher a watertable and salinisation of low lying areas.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> Old Dam
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

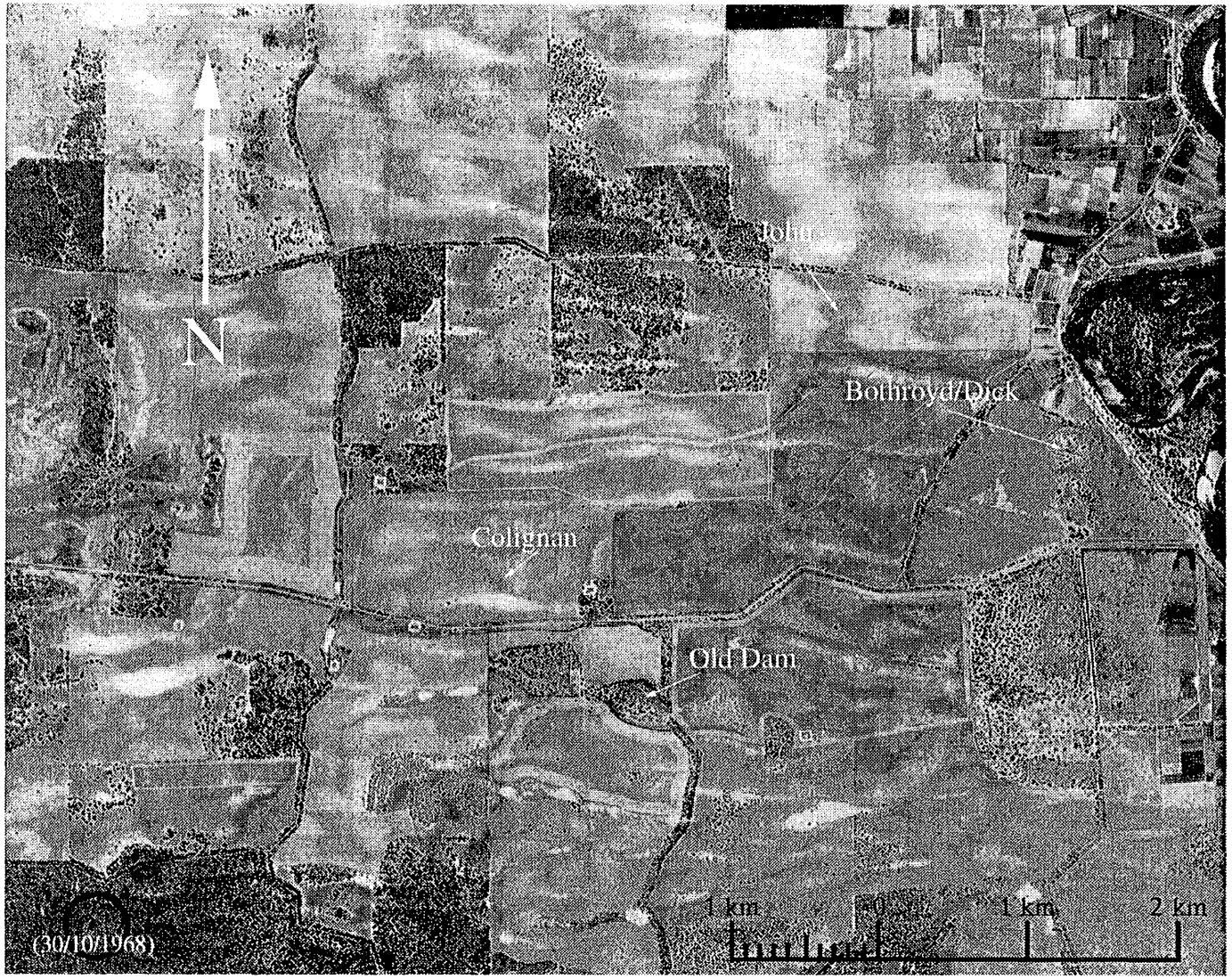
References Cited

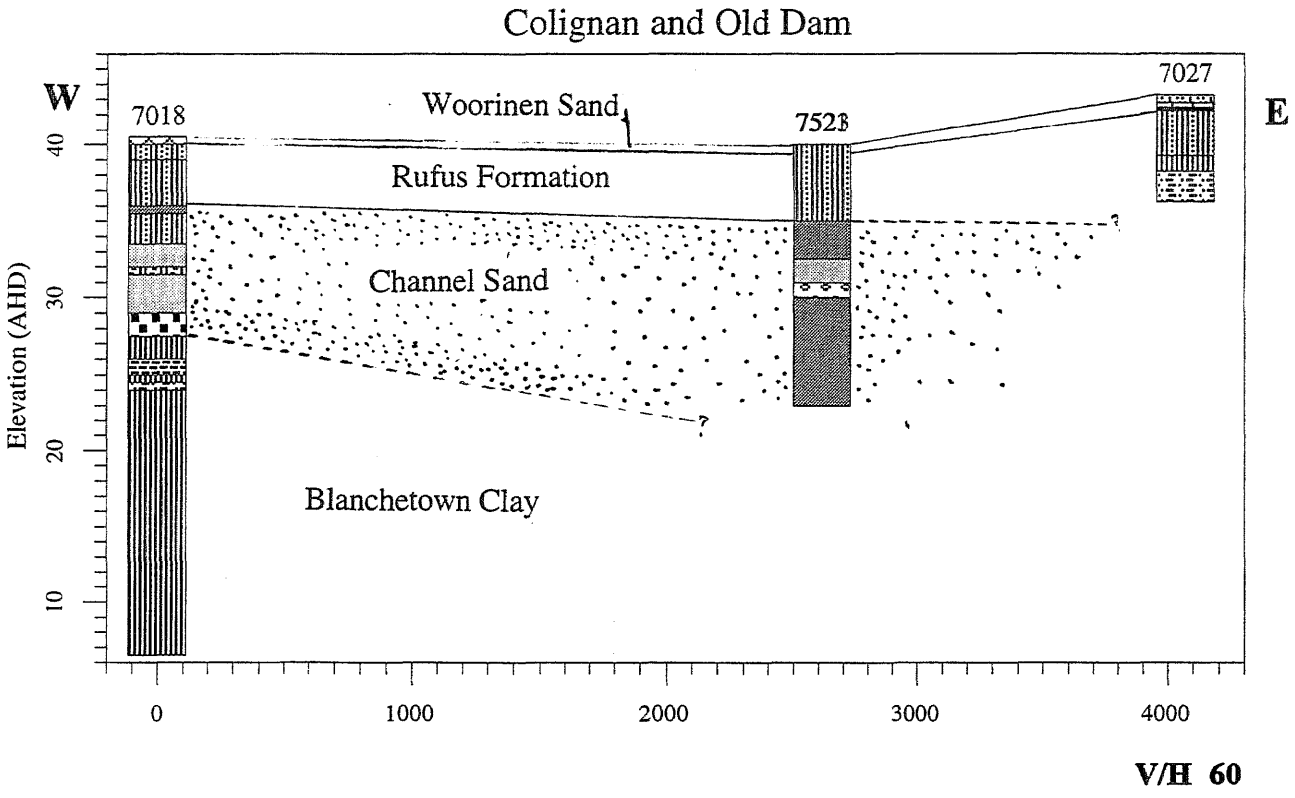
Linke, G., 1993- Nangiloc Colignan SMP - Drainage disposal to Karadoc Swamp - CMS Comps., Rural Water Corporation, Unpublished working file No. 93/01895

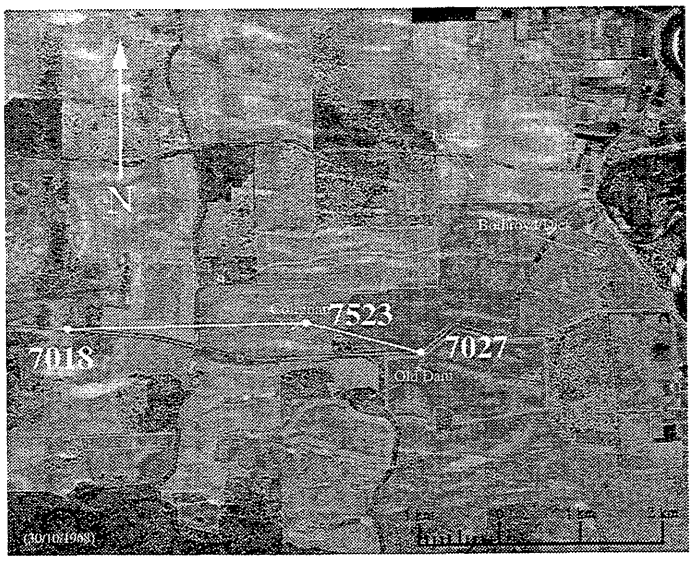
Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
Bothroyd/Dick
Colignan
Old Dam
1 km
0
1 km
2 km
(30/10/1968)


Colignan and Old Dam
W
E
7018
7523
7027
Woorinen Sand
Rufus Formation
Channel Sand
Blanchetown Clay
Elevation (AHD)
40
30
20
10
0
1000
2000
3000
4000
V/H 60


N
7523
7018
7027
Old Dam

<Site Name> Psyche Bend Lagoon
<Synonyms>

Spatial

<**Location description**> 6 kilometres NE of Red Cliffs, Victoria and 9 kilometres SE of Mildura, Victoria

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 612500

<**Coordinates northing (AMG)**> 6208000

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 104 ha (RWC, 1993); 27.2 ha at 34.75 m AHD (Linke, Gato, and Northey, 1991a)

<**Volume capacity (ML)**> 1005 ML

<**Full surface level (m AHD)**> 36 m AHD (RWC, 1993); 34.4-34.8 m AHD (Linke, Gato, and Northey, 1991a)

<**Groundwater level (m AHD)**> 36 m AHD (RWC, 1993); 35 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<**Groundwater seepage/discharge**> Discharge

<**Average annual evaporation**> Inflow/evaporation > 1.5; 1611 Class A pan Mildura, Victoria

<**Volume disposed annually (ML/yr)**> 2246 ML

<**Salinity of water disposed (EC)**> 2500 EC

<**Range of salinity in basin (EC)**> 8000-16000 EC

<**Sources of water to be disposed**> Drainage disposal and groundwater inflow

<**Terminal/throughflow basin**> Throughflow

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> Psyche Bend Lagoon
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Commission (Sunraysia Salinity Management Plan) and First Mildura Irrigation Trust (FMIT)

<**Project name**> Psyche Bend Lagoon

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is an abandoned meander loop of the Murray River. It is located within the Murray Trench and is surrounded by River Red Gums and other floodplain vegetation.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is northwest of the Red Cliffs Ridge and northeast of the Wargan Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Coonambidgal Formation (3-5 m), and underlain by the Channel Sand (Monoman Formation) (10-12 m), the Parilla Sand (30 m), the Bookpurnong beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990 and RWC bores 7985, 7983, and 7981).

<**Host formation**> Coonambidgal Formation

<**Host lithofacies**> Grey silty clay, sandy clay, and yellow-grey clayey sand

<**Aquitard**> Coonambidgal Formation

<**Aquitard lithofacies**> Grey silty clay, sandy clay, and yellow-grey clayey sand

<**Aquifer**> Channel Sand and Parilla Sand

<**Aquifer lithofacies**> Channel Sand: Grey green medium sand, yellow fine sand, and clayey sand

<**Comments**>

<Site Name> Psyche Bend Lagoon
<Synonyms>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> <500 metres

<**Head between basin and river/tributary**> 0.4 metres (Linke, Gato, and Northey, 1991a)

<**Direction of groundwater flow in regional aquifer**> Northeast towards the river (RWC, 1991)

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**>

<**Thickness of aquitard**> Coonambidgal Formation: 3-5 metres

<**kv and kh of aquifer**> Channel Sand: Kh = 20 m/day (Linke, Gato, and Northey, 1991a); Parilla Sand: Kh = 1.6 to 58 m/day (Duncan and Linke, 1992)

<**EC of aquifer**> Parilla Sand and Channel Sand: >50,000 mg/L TDS (RWC, 1993)

<**Porosity of aquifer**>

<**Thickness of aquifer**> Channel Sand: 10-12 metres; Parilla Sand: 30 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> There is groundwater discharge on the western margin of the lagoon and seepage to the river along the eastern margin although the seepage is dependant on river levels. The basin receives discharge from Kings Billabong, RWC Basin 12, and the Channel Sand aquifer (in contact with Parilla Sand), in addition to direct drainage disposal from FMIT mid-North drain for a total inflow of 2570 ML/yr. Seepage from the basin into the river totals 2050 ML/yr and a total salt load of 6540 tonnes/year which corresponds to a 2 EC rise at Morgan, South Australia. The long term effects of continued disposal into Psyche Bed Lagoon are expected to increase unless disposal patterns are changed (Linke, Gato, and Northey, 1991a).

<**Hydraulic linkage to surface runoff**>

<**Category - hydraulic stability**>

<Site Name> Psyche Bend Lagoon
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

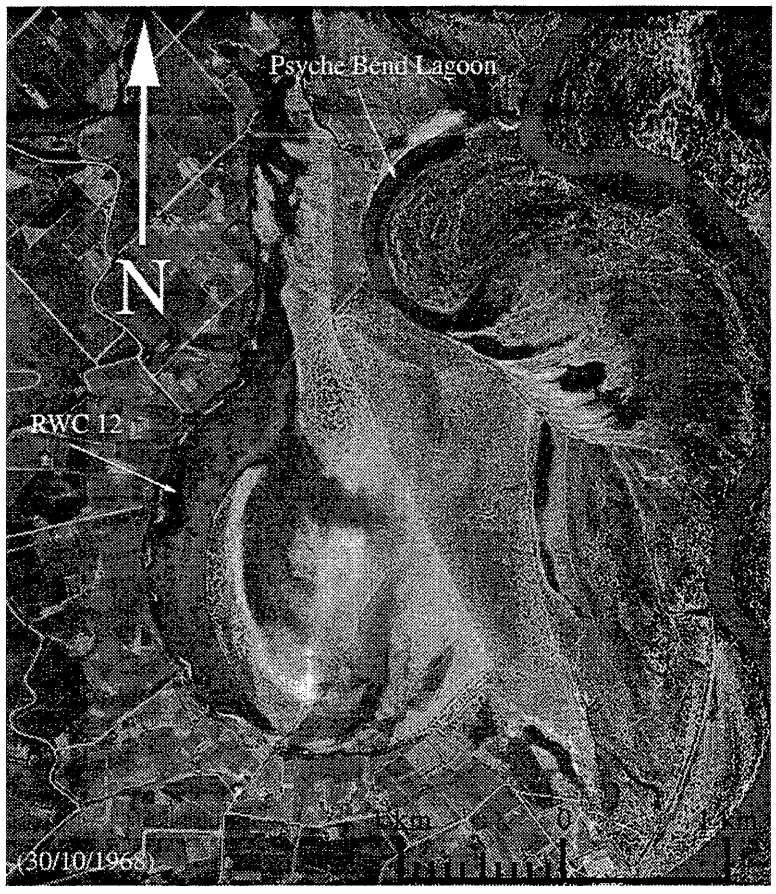
Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

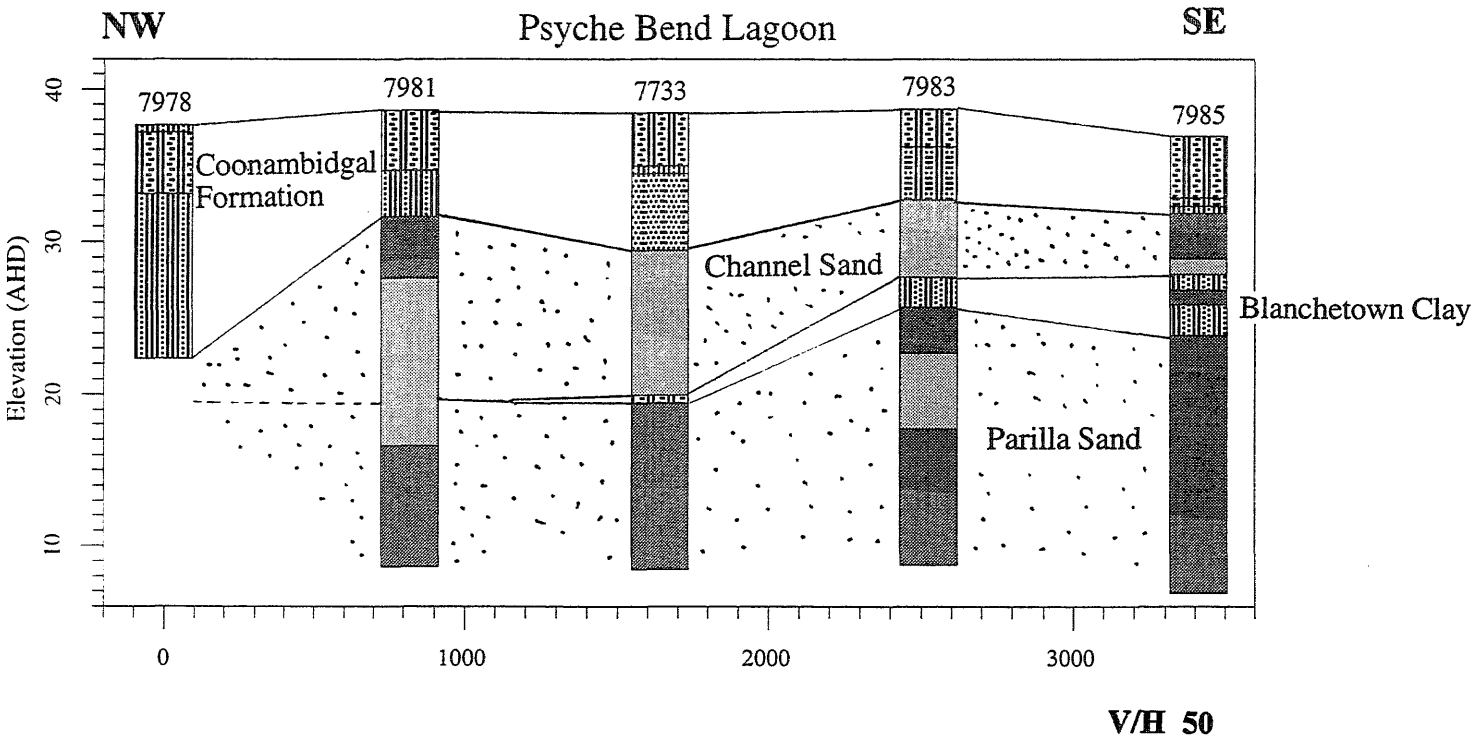
Linke, G.K., Gato, S., and Northey, P., 1991a- Evaluation of drainage disposal options for Red Cliffs: background report for Sunraysia Salinity Management Plan., Rural Water Commission of Victoria Report no. 1991/24

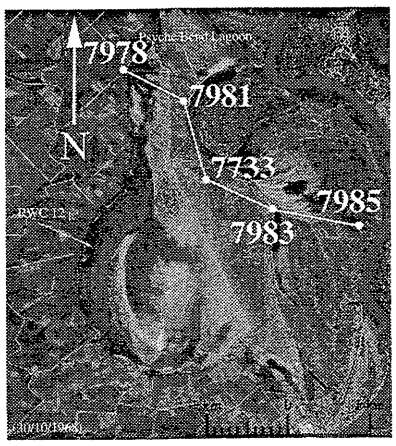
Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


Psyche Bend Lagoon
N
RWC 12
1 km
0
(30/10/1968)


NW
Psyche Bend Lagoon
SE
7978
7981
7733
7983
7985
Coonambidgal Formation
Channel Sand
Blanchetown Clay
Parilla Sand
Elevation (AHD)
40
30
20
10
0
1000
2000
3000
V/H 50


7978
7981
7733
7985
7983
N

<**Site Name**> Robinvale East
<**Synonyms**> Cemetery Billabong

Spatial

<**Location description**> Billabong 1 kilometre SE of cemetery and 3.5 kilometres SE of Robinvale, Victoria between Walshe's and Knight's Bend

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Balranald

<**Location 1:100 000**> Robinvale 7428

<**Zone**> 54H

<**Coordinates easting (AMG)**> 665200

<**Coordinates northing (AMG)**> 6168200

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**>

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**>

<**Groundwater level (m AHD)**> ~45 m AHD (Euston Weir height); Parilla Sand 48 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<**Groundwater seepage/discharge**> Depends on river level, usually seepage

<**Average annual evaporation**>

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**>

<**Sources of water to be disposed**> Irrigation outfall (monitored)

<**Terminal/throughflow basin**> Terminal although there is flood flushing

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> Robinvale East
<Synonyms> Cemetery Billabong

Engineering/Admin

<Public or private operation> Public

<Agency responsible> Rural Water Corporation

<Project name> Robinvale East

<Natural, modified natural or constructed> Natural

<Modification type and degree> None

Geological

<Site description and Geomorphology> The basin is a billabong on the Murray River floodplain.

<Subsurface investigations at site>

<Structural setting> The basin is located east of the Tyrrell Fault on the Murray River floodplain (Thorne, Hoxley, and Chaplin, 1990).

<Stratigraphic setting> The basin is floored by the Coonambidgal Formation (3-5 m), and underlain by the Channel Sand (5-7 m), the Blanchetown Clay (70 m), the Parilla Sand (80 m), the Bookpurnong Beds, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<Host formation> Coonambidgal Formation

<Host lithofacies> Clays and silts

<Aquitard> Coonambidgal Formation and Blanchetown Clay

<Aquitard lithofacies> Coonambidgal Formation: Clays and silts; Blanchetown Clay: clay, silty clay, and occasionally fine sand

<Aquifer> Channel Sand and Parilla Sand

<Aquifer lithofacies> Channel Sand and Parilla Sand: Fine to medium sand

<Comments>

Summary of Hydrodynamics

<Distance to Murray or tributary> < 100 metres

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Channel Sand: Northeast to the river,

<**Site Name**> Robinvale East
<**Synonyms**> Cemetery Billabong

Parilla Sand: Southeast away from the Murray River (Thorne, Hoxley, and Chaplin, 1990)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Coonambidgal Formation: 3-5 metres; Blanchetown Clay: 70 metres

<kv and kh of aquifer>

<EC of aquifer> Channel Sand: 500 EC; Parilla Sand: 2000 EC (Thorne, Hoxley, and Chaplin, 1990)

<Porosity of aquifer>

<Thickness of aquifer> Channel Sand: 5-7 metres; Parilla Sand: 80 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface> Irrigation beneath Robinvale has recharged the Parilla Sand on the west side of the Tyrrell Fault causing a drop of aquifer salinities.

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin has the capacity to leak into the Channel Sand aquifer because of the difference in the full level of the basin and the potentiometric surface of the Channel Sand. However, the amount of leakage is probably small due to the presence of the Coonambidgal Formation aquitard and the low differential between the basin and the river. There is little chance of leakage into the Parilla Sand because of the high potentiometric pressure in the Parilla due to the irrigation mound beneath Robinvale, and because of the thick (70 m) layer of Blanchetown Clay.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

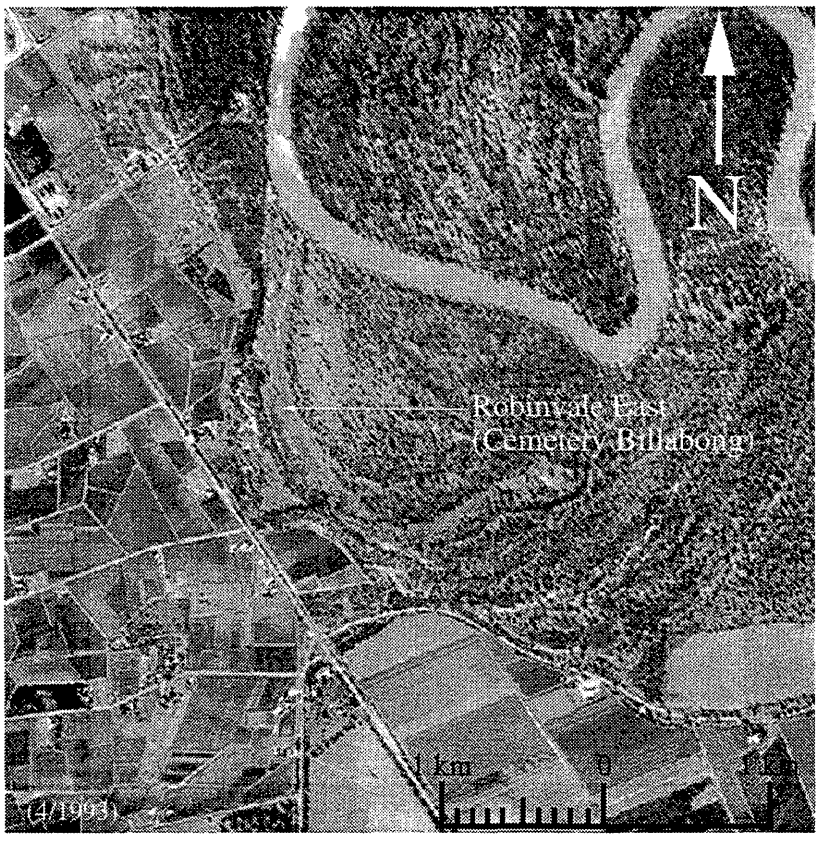
<Site Name> Robinvale East
<Synonyms> Cemetery Billabong

Interpretive 2

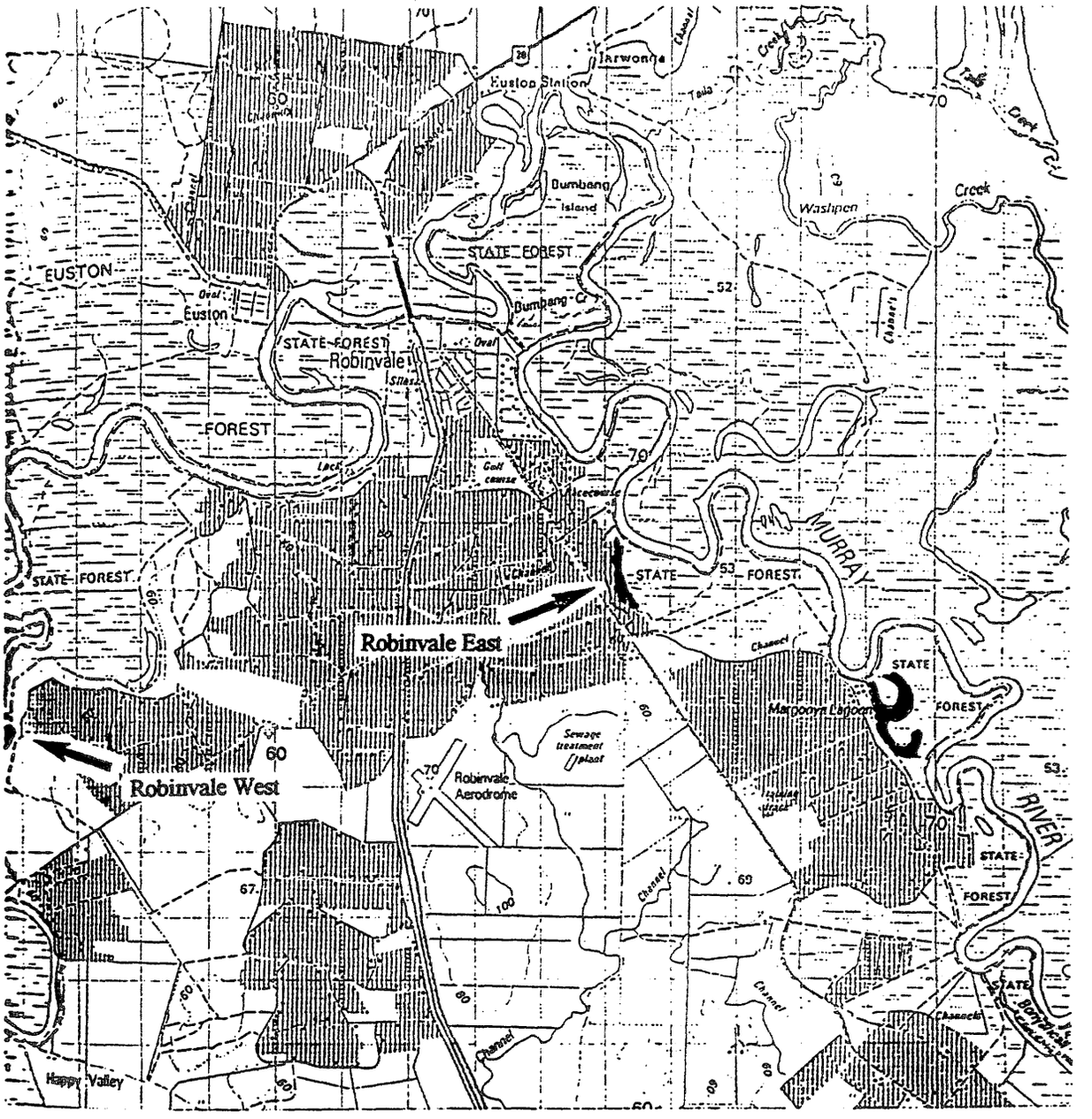
<Ranking of sustainability>

References Cited

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
Robinvale East
(Cemetery Billabong)
1 km
0
1 km
(4/1993)

Robinvale Area



after (Hoxley, 1991, TN1)

<Site Name> Robinvale West
<Synonyms>

Spatial

<**Location description**> W1: 6.5 kilometres SW of Robinvale in SE corner of State Forest; W2: 8.5 kilometres WSW of Robinvale in neck of State Forest

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Balranald

<**Location 1:100 000**> Robinvale 7428

<**Zone**> 54H

<**Coordinates easting (AMG)**> W1: 658100; W2: 655600

<**Coordinates northing (AMG)**> W1: 6167000; W2: 6165800

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**>

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**>

<**Groundwater level (m AHD)**> Parilla Sand and Channel Sand: ~43 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<**Groundwater seepage/discharge**> Depends on river height, usually seepage

<**Average annual evaporation**>

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**>

<**Sources of water to be disposed**> Irrigation outfall (monitored)

<**Terminal/throughflow basin**> Terminal (partial flushing)

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**> Reed bed vegetation continued to expand at drainage disposal sites. Degraded floodplain expected to erode? (Bluml, 1992)

<Site Name> Robinvale West
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Robinvale West

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> Both basins are located on a high alluvial plain (Rufus Terrace?) with W1 located on the edge of the floodplain and W2 located in a flood channel on a narrow floodplain (Bluml, 1992).

<**Subsurface investigations at site**>

<**Structural setting**> The basins are located west of the Tyrrell Fault and east of the Wemen Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basins are floored by the Coonambidgal Formation (3-5 m), and are underlain by the Channel Sand (5-7 m), the Parilla Sand (40 m), the Bookpurnong Beds, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Coonambidgal Formation

<**Host lithofacies**> Clays and silts

<**Aquitard**> Coonambidgal Formation

<**Aquitard lithofacies**> Clays and silts

<**Aquifer**> Channel Sand and Parilla Sand

<**Aquifer lithofacies**> Channel Sand and Parilla Sand: Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> W1: 1.5 kilometres; W2: 300 metres

<**Head between basin and river/tributary**>

<Site Name> Robinvale West
<Synonyms>

<**Direction of groundwater flow in regional aquifer**> Channel Sand: Towards the river; Parilla Sand: west towards the river (River traverses indicate that 50-70 tonnes/day of salt is entering the river near the basin, probably driven by the irrigation mound beneath Robinvale (Foley, 1992)).

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**>

<**Thickness of aquitard**> Coonambidgal Formation: 3-5 metres

<**kv and kh of aquifer**>

<**EC of aquifer**> ~2000 Ec although it can be up to 40,000 EC (Thorne, Hoxley, and Chaplin, 1990)

<**Porosity of aquifer**>

<**Thickness of aquifer**> Channel Sand and Parilla Sand: 45-50 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> The basin has the potential to leak into the Parilla Sand, due to the full level of the basin being higher than the potentiometric surface of the Parilla. However leakage will be lessened because the basin is separated from the aquifer by the low permeability Coonambidgal Formation, which will help to isolate the basin and because of the small difference between river height and basin level. Once water does enter the Channel Sand it can also enter the Parilla Sand because the two aquifers (most places) are intermixed. The effects however will be negligible compared to the 50-70 tonnes/day of salt entering the river nearby driven by irrigation accessions under Robinvale.

<**Hydraulic linkage to surface runoff**>

<**Category - hydraulic stability**>

<**Category - degree of hydraulic isolation**>

<Site Name> Robinvale West
<Synonyms>

<Evaporation surplus>

Interpretive 2

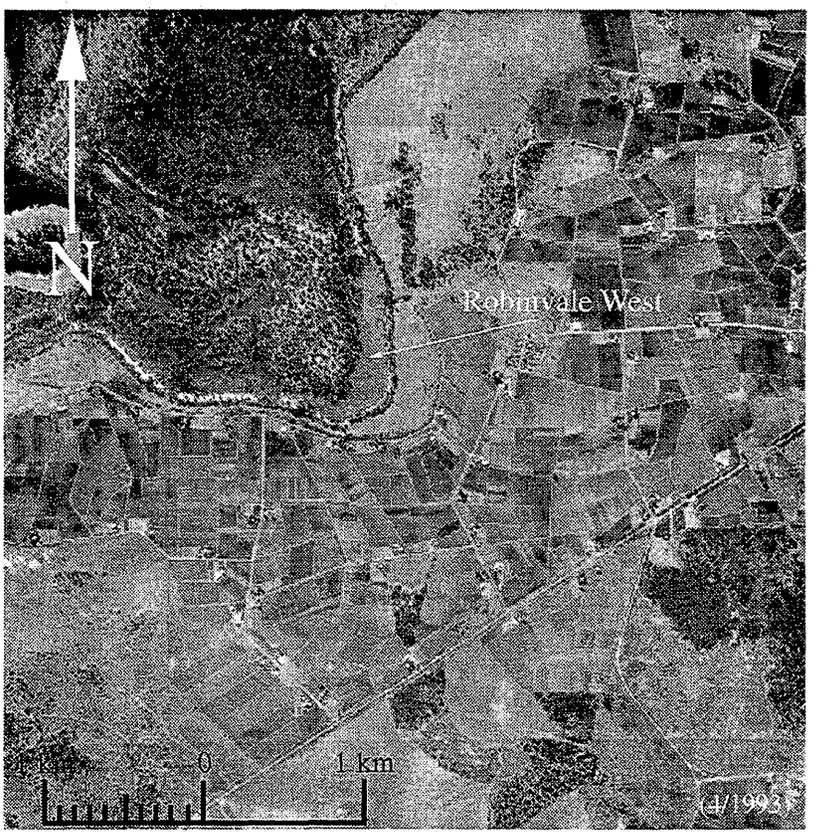
<Ranking of sustainability>

References Cited

Bluml, M., 1992- Sunraysia Salinity management Plan Environment report., Dept of Conservation and Environment, ISBN 0 7306 2715 2, 103 p.

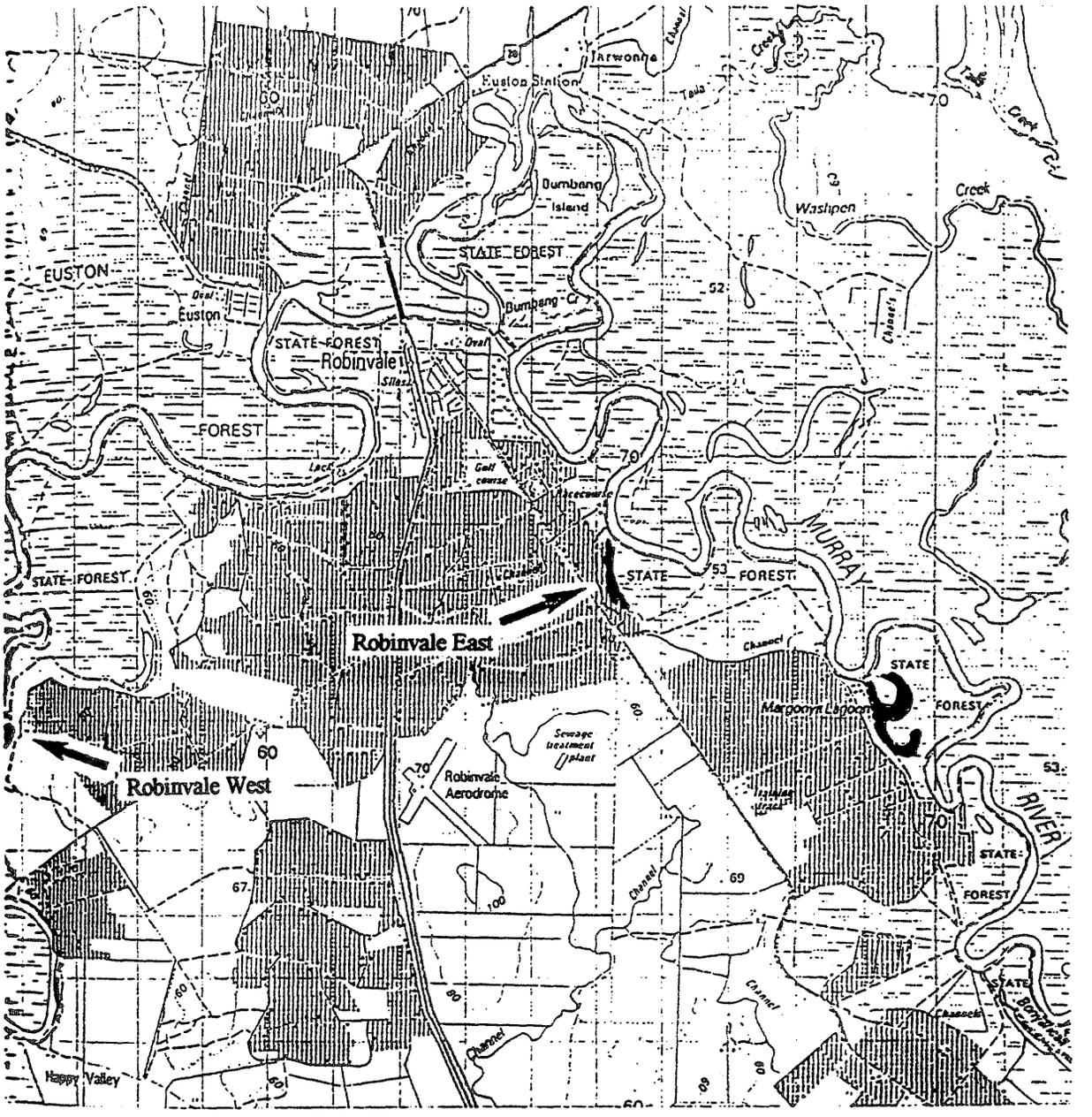
Foley, G., 1992- Salinity traverse of the Murray River: Euston Weir to Wemen Results of the March and May 1991 traverses., Rural Water Corporation, Unpublished report TN 49

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.



R9500409

Robinvale Area



after (Hoxley, 1991, TN1)

<**Site Name**> RWC 1 (includes 1a, 2 and 3)
<**Synonyms**> Red Cliffs 1
Lake Cardross

Spatial

<**Location description**> 8 kilometres west of Red Cliffs, Victoria and 10 kilometres SW of Irymple, Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 601000

<**Coordinates northing (AMG)**> 6203000

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 181 ha

<**Volume capacity (ML)**> 5470 ML

<**Full surface level (m AHD)**> 41.1 m AHD

<**Groundwater level (m AHD)**> 38 m AHD (RWC, 1993); 37.5-38.5 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> Inflow/evaporation = 0.3; 1980 mm/yr Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**> 551 ML/yr

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**> 3670-3700 EC

<**Sources of water to be disposed**> Red Cliffs Irrigation District

<**Terminal/throughflow basin**> Throughflow

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> RWC 1 (includes 1a, 2 and 3)
<Synonyms> Red Cliffs 1
Lake Cardross

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Red Cliffs Irrigation District

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is located in a depression between the longitudinal Woorinen dunes. Recent expansion has linked basin 1, 1a, 2, and 3 forming a large rectangular basin. The Woorinen Formation appears to be less pronounced around the basin perhaps suggesting an area of deflation or erosion associated with the Wargan Fault.

<**Subsurface investigations at site**>

<**Structural setting**> The basin lies on the Wargan Fault, southeast of the Danyo Fault and northwest of the Red Cliffs Ridge (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (2-3 m) and underlain by the Blanchetown Clay (20-25 m), the Parilla Sand (50 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay and silty clay; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Parilla Sand: Fine to medium sand

<**Comments**> The basin has been expanded so that it now includes old basins 1a, 2, and 3.

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 13 kilometres

<**Head between basin and river/tributary**>

<**Site Name**> RWC 1 (includes 1a, 2 and 3)
<**Synonyms**> Red Cliffs 1
Lake Cardross

<**Direction of groundwater flow in regional aquifer**> Southeast away from the river

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**>

<**Thickness** of aquitard> Blanchetown Clay: 20-25 metres; Upper Parilla Sand: 7-10 metres

<**kv and kh of aquifer**> 1 m/day (Linke, 1990b)

<**EC of aquifer**> > 50,000 mg/L TDS (RWC, 1993); 50,000 EC (Thorne, Hoxley, and Chaplin, 1990)

<**Porosity of aquifer**>

<**Thickness of aquifer**> Parilla Sand: 30-35 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**> The basin has only recently formed due to growth in the irrigation mound beneath Mildura (Bluml, 1992).

Interpretive 1

<**Hydraulic linkage to regional aquifer**> The salinity of Lake Cardross is constant at ~4000 EC which is very low considering the high rate of evaporation in the basin (3500 ML/yr) and the amount of tile drainage it receives (512 ML/yr). This suggests that the basin is receiving large volumes of groundwater (via the perched aquifer within the Woorinen Formation) from the irrigation mound in the Mildura area. There are at least three possibilities of why the salinity of the basin remains low. First, the basin may receive so much discharge from the Woorinen Formation that it overwhelms the evaporative concentration. This would indicate that the mound within the perched aquifer is growing very quickly and is not allowing the basin to come into equilibrium. Second, the basin may be acting as a throughflow basin in which the basin is a window in the perched watertable allowing little or no evaporative concentration to occur. Third, the basin may leak through the Blanchetown Clay, either into the Irymple Member of the Blanchetown Clay (on top of the Upper Parilla Sand) or into the Parilla itself. The permeability of the Blanchetown Clay and Upper Parilla Sand may be fractured enhanced under then basin due to the presence of the Wargan Fault which provides a conduit for the disposal water. Water that does enter the Parilla Sand, will flow away from the river, and eventually enter South Australia.

<**Hydraulic linkage to surface runoff**>

<**Category - hydraulic stability**>

<Site Name> RWC 1 (includes 1a, 2 and 3)
<Synonyms> Red Cliffs 1
Lake Cardross

<Category - degree of hydraulic isolation>

<Evaporation surplus> The basin receives 510 ML/yr of tile drainage and evaporates 3583 ML/yr (1980 mm/yr x 181 ha).

Interpretive 2

<Ranking of sustainability>

References Cited

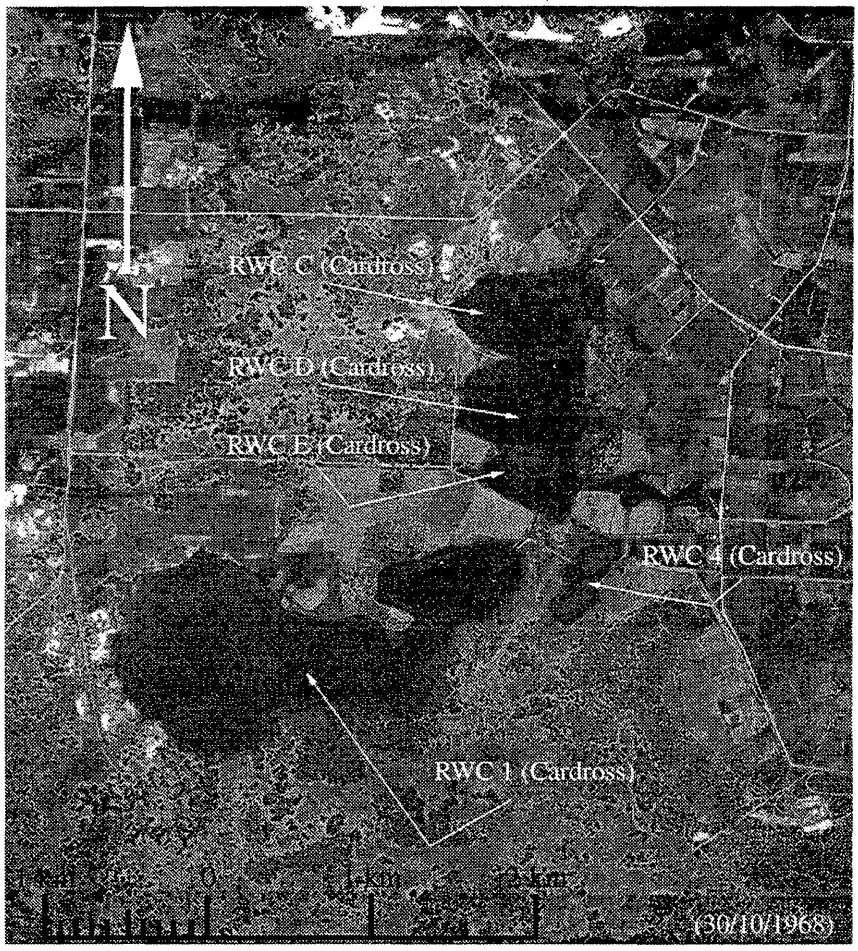
Bluml, M., 1992- Sunraysia Salinity management Plan Environment report., Dept of Conservation and Environment, ISBN 0 7306 2715 2, 103 p.

Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990-Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
RWC C (Cardross)
RWC D (Cardross)
RWC E (Cardross)
RWC 4 (Cardross)
RWC 1 (Cardross)
0
1 km
2 km
(30/10/1968)

<Site Name> RWC 4
<Synonyms> Red Cliffs 4
Cardross

Spatial

<Location description> 6.5 kilometres west of Red Cliffs and 9 kilometres SSW of Irymple, Victoria

<Located in Murray Trench> No

<Location 1:250 000> Mildura

<Location 1:100 000> Mildura 7329

<Zone> 54

<Coordinates easting (AMG)> 602800

<Coordinates northing (AMG)> 6203600

<State> Victoria

General

<Year begun operation>

<Active/inactive> Active

<Full surface area (ha)> 16.6

<Volume capacity (ML)> 106 ML

<Full surface level (m AHD)> 41.4 m AHD

<Groundwater level (m AHD)> 38 m AHD

<Groundwater seepage/discharge> Seepage

<Average annual evaporation> Inflow/evaporation = 0.3; 1980 mm/yr Class A pan Red Cliffs

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)>

<Sources of water to be disposed> Red Cliffs Irrigation District

<Terminal/throughflow basin> Throughflow to RWC 1,2,3

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> RWC 4
<Synonyms> Red Cliffs 4
Cardross

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Red Cliffs Irrigation District

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is located in a depression among the Woorinen dunes and consists of two intrabasins separated (although under water) by a saddle (dune). It is surrounded by cropland and uncleared mallee.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is just northeast of the Wargan Fault, southeast of the Danyo Fault, and northwest of the Red Cliffs Ridge (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (3-5 m), and underlain by the Blanchetown Clay (15-20 m), the Parilla Sand (50 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay and silty clay; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand.

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Parilla Sand: Fine to medium grained sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 11 kilometres

<**Head between basin and river/tributary**>

<Site Name> RWC 4
<Synonyms> Red Cliffs 4
Cardross

<Direction of groundwater flow in regional aquifer> Southwest away from the Murray River (RWC, 1991).

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Blanchetown Clay: 15-20 metres; Upper Parilla Sand: 5-7 metres

<kv and kh of aquifer> Parilla Sand: 1 m/day (Linke, 1990b)

<EC of aquifer> > 50,000 mg/L TDS

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 50 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> RWC 4, is a throughflow basin that drains into Lake Cardross. The amount of disposal into the basin is unknown, but airphotos show that the basin is usually full. The evaporative capacity of the basin is 383 ML/yr suggesting that either the basin receives a large volume of tile drainage, or that it is receiving water from another source such as the perched watertable in the Woorinen Formation. Downwards leakage into the Parilla Sand is probably minimal because water will preferentially leak back into the Woorinen Formation (throughflow in the perched aquifer) or be pumped there directly to Lake Cardross before it can enter the Parilla Sand.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Site Name> RWC 4
<Synonyms> Red Cliffs 4
Cardross

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

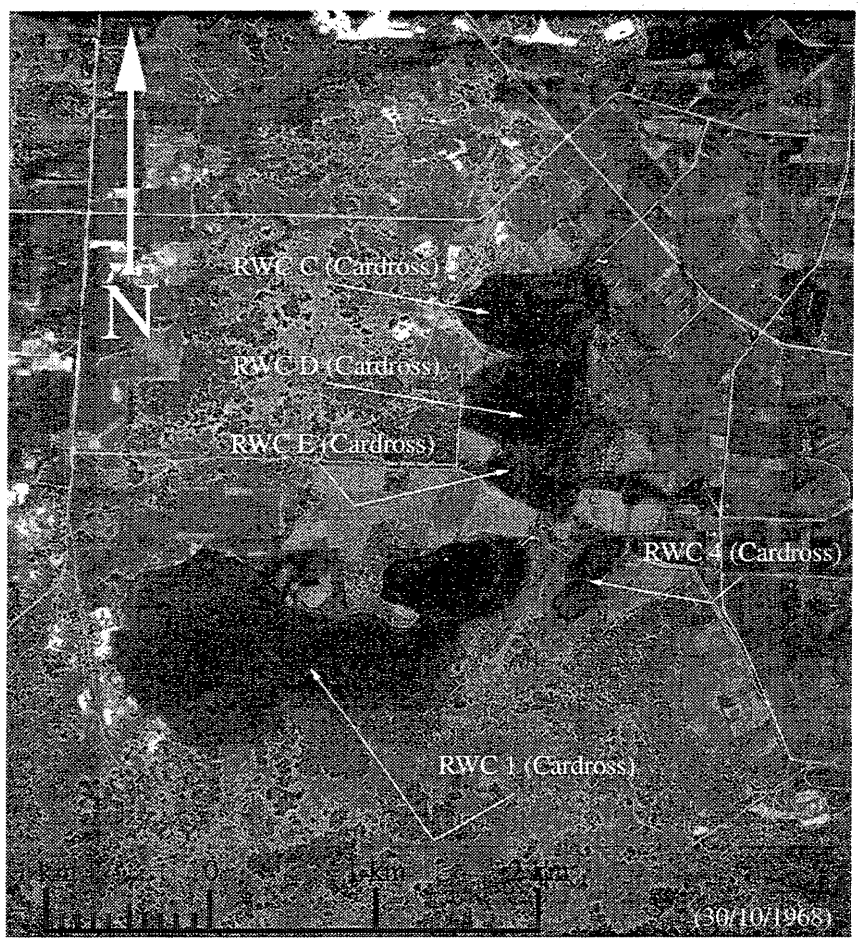
References Cited

Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
RWC C (Cardross)
RWC D (Cardross)
RWC E (Cardross)
RWC 4 (Cardross)
RWC 1 (Cardross)
1 km
(30/10/1968)

<Site Name> RWC 5
<Synonyms> Red Cliffs 5

Spatial

<Location description> 3 kilometres WSW of Red Cliffs, Victoria and 12 kilometres SSW of Irymple, Victoria

<Located in Murray Trench> No

<Location 1:250 000> Mildura

<Location 1:100 000> Mildura 7329

<Zone> 54

<Coordinates easting (AMG)> 605500

<Coordinates northing (AMG)> 6201300

<State> Victoria

General

<Year begun operation>

<Active/inactive> Active

<Full surface area (ha)> 29 ha

<Volume capacity (ML)> 500 ML

<Full surface level (m AHD)> 52.83 m AHD

<Groundwater level (m AHD)> 38.5 m AHD

<Groundwater seepage/discharge> Seepage

<Average annual evaporation> Inflow/evaporation = 0.3; 1980 mm/yr Class A pan Red Cliffs

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)>

<Sources of water to be disposed> Red Cliffs Irrigation District

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> RWC 5
<Synonyms> Red Cliffs 5

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Red Cliffs Irrigation District

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Channel cut at most westerly point of depression diverting water to basin to the west.

Geological

<**Site description and Geomorphology**> The basin lies in a depression among the longitudinal Woorinen dunes and is surrounded by uncleared mallee and cropland.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located on the Red Cliffs Ridge, northeast of the Wargan Fault, and southeast of the Danyo Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (5 m), and underlain by the Parilla Sand (30 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Upper Parilla Sand

<**Aquitard lithofacies**> Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 9 kilometres

<**Head between basin and river/tributary**>

<Site Name> RWC 5
<Synonyms> Red Cliffs 5

<Direction of groundwater flow in regional aquifer> South away from the Murray River (RWC, 1991).

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Upper Parilla Sand: 5-7 metres

<kv and kh of aquifer> Parilla Sand: 1 m/day (Linke, 1990b)

<EC of aquifer> > 50,000 mg/L TDS (RWC, 1993)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 23-25 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin has the potential to leak into the Parilla Sand because of the large difference in head (12.3 m) between the basin and the Parilla, and because of the absence of the Blanchetown Clay. Air photos reveal that the basin is full despite the fact that disposal is one-third the amount of evaporation (574 ML/yr) suggesting another source of water for the basin. The most likely candidate is discharge from the perched watertable in the Woorinen Formation, which is fed by accession of irrigation water beneath Mildura-Red Cliffs. However, another possibility is that the airphoto may have been taken during a period of high disposal. Regardless, a basin full condition enhances the possibility of seepage from the basin by providing both a head and a reservoir.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> RWC 5
<Synonyms> Red Cliffs 5

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

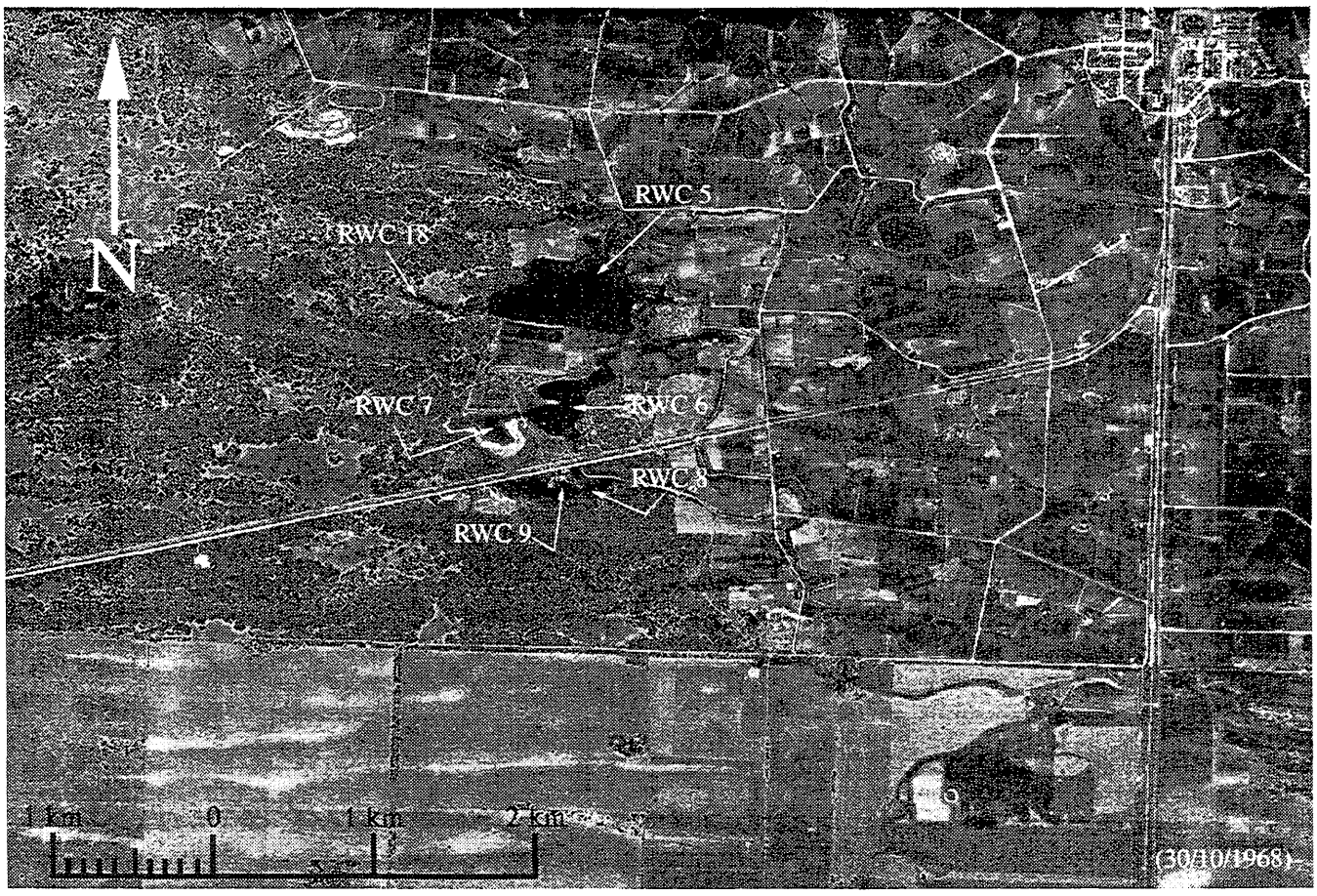
References Cited

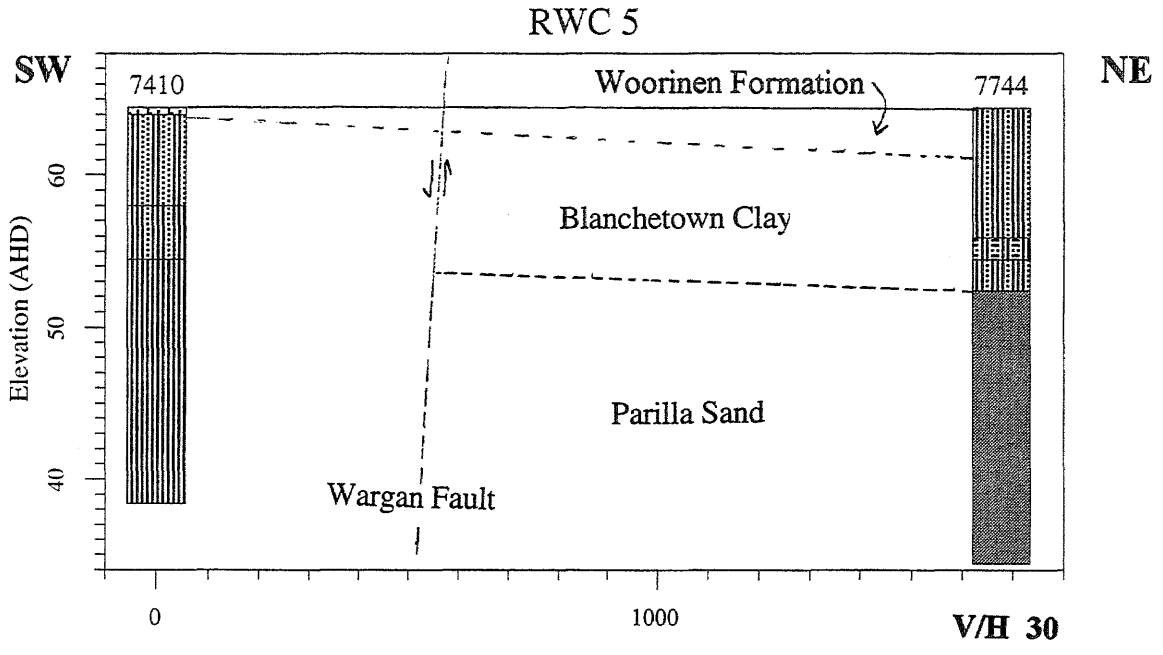
Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

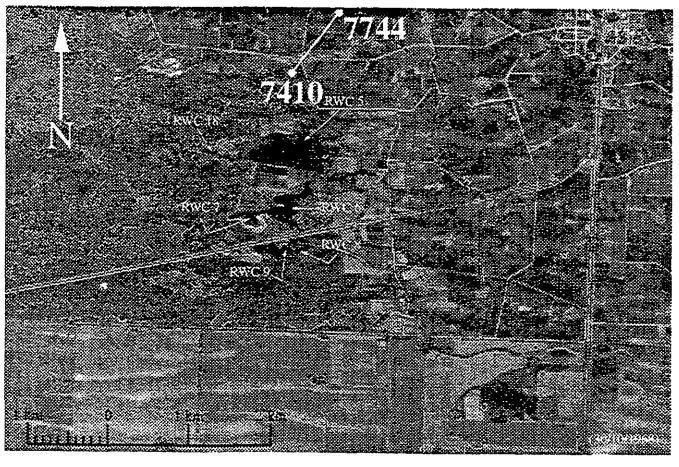
Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
RWC 5
RWC 18
RWC 7
RWC 6
RWC 8
RWC 9
1 km
0
1 km
2 km
(30/10/1968)


RWC 5
SW
NE
7410
7744
Woorinen Formation
Blanchetown Clay
Parilla Sand
Wargan Fault
Elevation (AHD)
60
50
40
0
1000
V/H 30


7744
7410
N

<Site Name> RWC 6
<Synonyms> Red Cliffs 6

Spatial

<Location description> 5 kilometres SW of Red Cliffs, Victoria and 4 kilometres ENE of Thurla, Victoria

<Located in Murray Trench> No

<Location 1:250 000> Mildura

<Location 1:100 000> Mildura 7329

<Zone> 54

<Coordinates easting (AMG)> 605400

<Coordinates northing (AMG)> 6200600

<State> Victoria

General

<Year begun operation>

<Active/inactive> Active

<Full surface area (ha)> 12.4 ha

<Volume capacity (ML)> 80 ML

<Full surface level (m AHD)> 49.4 m AHD

<Groundwater level (m AHD)> 38 m AHD

<Groundwater seepage/discharge> Seepage

<Average annual evaporation> Inflow/evaporation = 0.85

<Volume disposed annually (ML/yr)> 217 ML/yr

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)>

<Sources of water to be disposed> Red Cliffs Irrigation District

<Terminal/throughflow basin> Throughflow

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> RWC 6
<Synonyms> Red Cliffs 6

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Red Cliffs Irrigation District

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Culvert constructed at neck between basins 6 and 7.

Geological

<**Site description and Geomorphology**> The basin is located in a depression within the longitudinal Woorinen dunes and is surrounded by uncleared mallee. Airphotos show that the basin is full and suggest that there may be some salt deposition along the basin's margins.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is on the Red Cliffs Ridge, northeast of the Wargan Fault, and southeast of the Danyo Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (5-10 m) and underlain by the Blanchetown Clay (5-10 m), the Parilla Sand (35-40 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay and silty clay; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 10 kilometres

<**Head between basin and river/tributary**>

<Site Name> RWC 6
<Synonyms> Red Cliffs 6

<Direction of groundwater flow in regional aquifer> South away from the River Murray (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Blanchetown Clay: 5-10 metres; Upper Parilla Sand: 5-7 metres

<kv and kh of aquifer> Parilla Sand: 1 m/day (Linke, 1990b)

<EC of aquifer> 38,000 mg/L TDS

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand 30 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin receives tile drainage and is connected with RWC 7 allowing disposal of overflow water to Basin 7. Leakage into the Parilla Sand is possible because of the large difference in head between the basin (49.4 m AHD) and the aquifer (38 m AHD) and because of the relatively thin layer of Blanchetown Clay (10 m). There may also be some component of groundwater discharge into the basin from the perched aquifer in the Woorinen Sand. The perched watertable has grown along with the Parilla Sand in the past fifty years because of accession of irrigation water. Airphotos reveal that the basin is full while Basin 7 is half full. Combined they have an evaporation capacity of 433 ML/yr which is twice the amount of disposal (217 ML). Therefore a full basin condition may indicate another water source.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Site Name> RWC 6
<Synonyms> Red Cliffs 6

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

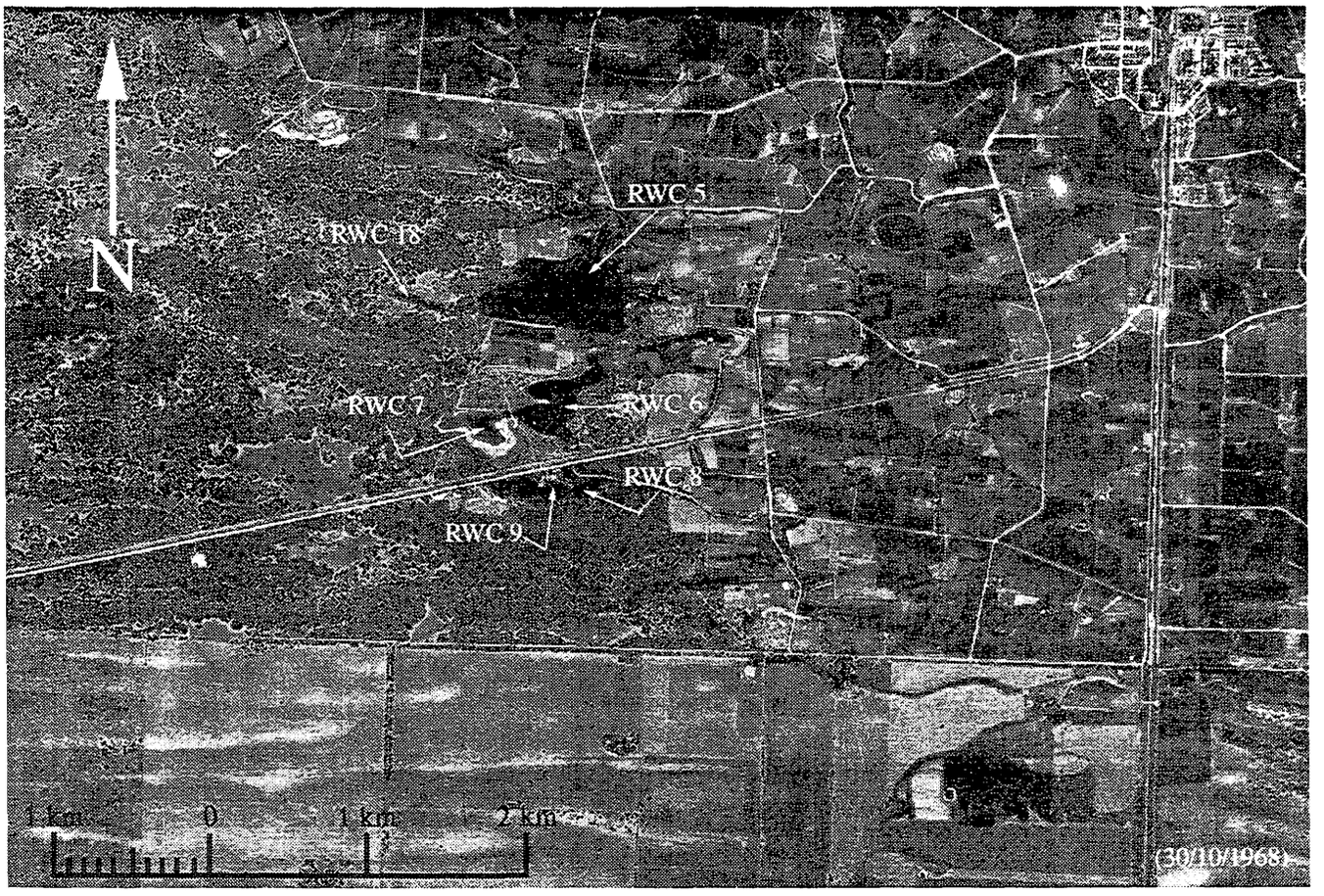
References Cited

Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
RWC 5
RWC 18
RWC 7
RWC 6
RWC 8
RWC 9
1 km
0
1 km
2 km
(30/10/1968)

<Site Name> RWC 7
<Synonyms> Red Cliffs 7

Spatial

<**Location description**> 5 kilometres SW of Red Cliffs, Victoria and 4 kilometres ENE of Thurla, Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 605100

<**Coordinates northing (AMG)**> 6200500

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 9.5 ha

<**Volume capacity (ML)**> 60 ML

<**Full surface level (m AHD)**> 49.4 m AHD

<**Groundwater level (m AHD)**> 38 m AHD

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> Inflow/evaporation = 0.85; 1980 mm/yr Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**> 217 ML/yr

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**>

<**Sources of water to be disposed**>

<**Terminal/throughflow basin**> Throughflow

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> RWC 7
<Synonyms> Red Cliffs 7

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Red Cliffs Irrigation District

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Connect to RWC 6 by a culvert constructed at the neck between the basins.

Geological

<**Site description and Geomorphology**> The basin is located in a depression within the longitudinal Woorinen dunes and is surrounded by uncleared mallee. Salt flat at the margin of the basin suggest either long term discharge or recent variability in size of basin due to disposal.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is on the Red Cliffs Ridge, northeast of the Wargan Fault, and southeast of the Danyo Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (5-10 m) and underlain by the Blanchetown Clay (5-10 m), the Parilla Sand (35-40 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay and silty clay; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 10 kilometres

<**Head between basin and river/tributary**>

<Site Name> RWC 7
<Synonyms> Red Cliffs 7

<Direction of groundwater flow in regional aquifer> South away from the River Murray (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Blanchetown Clay: 5-10 metres; Upper Parilla Sand: 5-7 metres

<kv and kh of aquifer> Parilla Sand: Kh = 1 m/day (Linke, 1990b)

<EC of aquifer> 35,000 mg/L TDS

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 30 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin receives tile drainage via its connection with RWC 6, only when Basin 6 overflows. Leakage into the Parilla Sand is possible because of the large difference in head between the basin (49.4 m AHD) and the aquifer (38 m AHD) and because of the relatively thin layer of Blanchetown Clay. There may also be some component of groundwater discharge into the basin from the perched aquifer in the Woorinen Sand. The perched watertable has grown along with the Parilla Sand in the past fifty years because of accession of irrigation water. Airphotos reveal that the basin is half full while Basin 6 is completely full. Combined they have an evaporation capacity of 433 ML/yr which is twice the amount of disposal (217 ML). Therefore a full basin condition may indicate another water source.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Site Name> RWC 7
<Synonyms> Red Cliffs 7

<Evaporation surplus> Combined evaporation 433 ML/yr (1980 mm/yr x 22.9 ha)

Interpretive 2

<Ranking of sustainability>

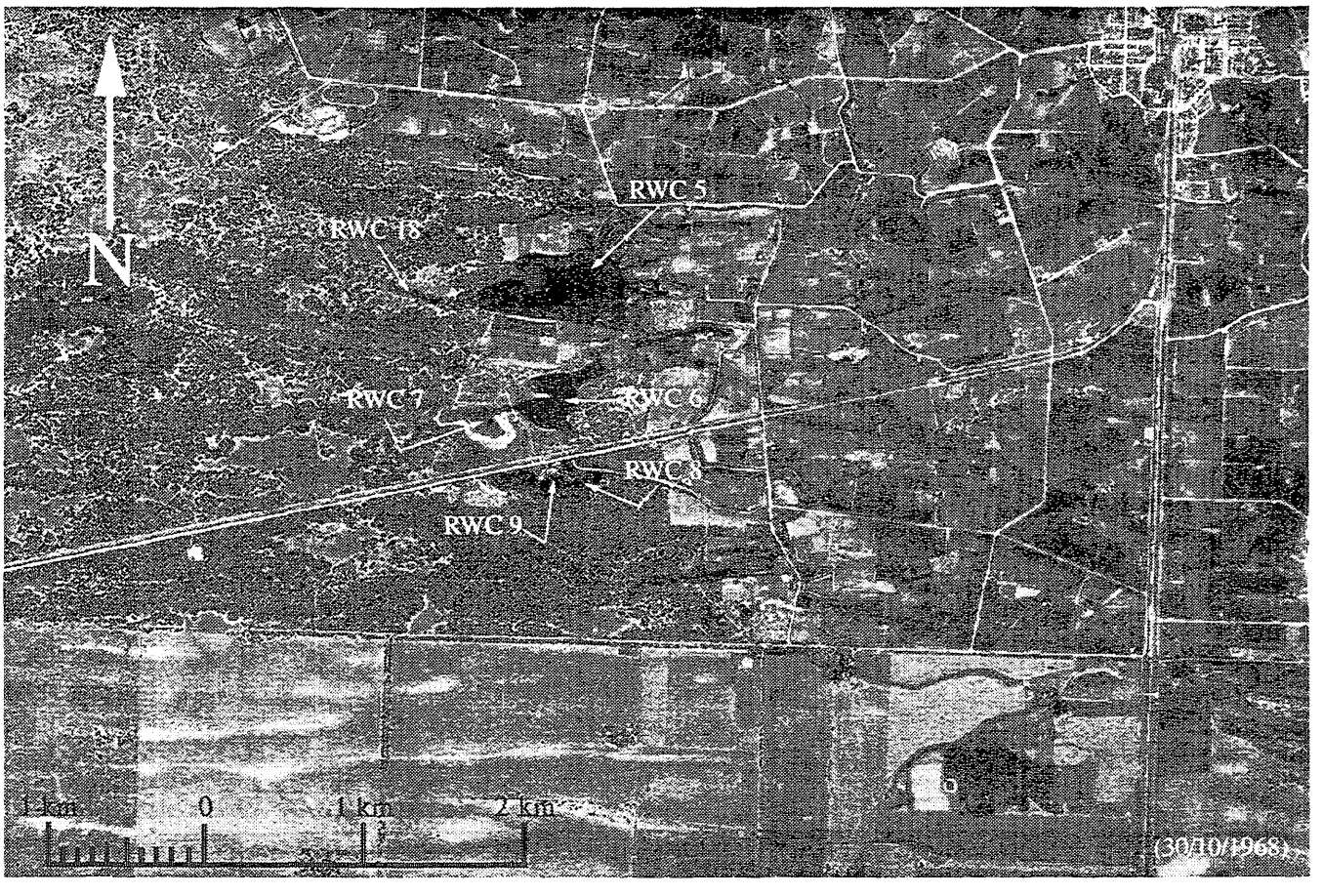
References Cited

Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
RWC 5
RWC 18
RWC 7
RWC 6
RWC 8
RWC 9
1 km
0
1 km
2 km
(30/10/1968)

<Site Name> RWC 8
<Synonyms> Red Cliffs 8

Spatial

<**Location description**> 5 kilometres SW of Red Cliffs, Victoria and 5.3 kilometres ENE of Thurla

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 605300

<**Coordinates northing (AMG)**> 6200200

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 6.3 ha

<**Volume capacity (ML)**> 26 ML

<**Full surface level (m AHD)**> 49.47 m AHD

<**Groundwater level (m AHD)**> 38 m AHD

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> Inflow/evaporation = 0.85

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**> Dry

<**Sources of water to be disposed**>Red Cliffs Irrigation District

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> RWC 8
<Synonyms> Red Cliffs 8

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Red Cliffs Irrigation District

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Levee bank constructed along northern boundary of basin abutting the Red Cliffs-Morkalla Road.

Geological

<**Site description and Geomorphology**> The basin is a small depression within the longitudinal Woorinen dunes and is surrounded by uncleared mallee. The basin is reported to be dry, but airphotos suggest that there is at least some dampness in the sand.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is on the Red Cliffs Ridge, northeast of the Wargan Fault, and southeast of the Danyo Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (5-10 m) and underlain by the Blanchetown Clay (5-10 m), the Parilla Sand (35-40 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay and silty clay; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 10 kilometres

<**Head between basin and river/tributary**>

<**Direction of groundwater flow in regional aquifer**> South away from the River Murray (RWC, 1991)

<Site Name> RWC 8
<Synonyms> Red Cliffs 8

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Blanchetown Clay: 5-10 metres; Upper Parilla Sand: 5-7 metres

<kv and kh of aquifer> Parilla Sand: Kh = 1 m/day (Linke, 1990b)

<EC of aquifer> 35,000 mg/L TDS

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand 30 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin is dry and has never been used, so it is difficult to estimate potential problems. The potential does exist for leakage into the Parilla Sand because of the large difference in hydraulic head between the basin and the aquifer and the relative thinness of the Blanchetown Clay (5-10 metres). However, any problems would be minimal because of the size of the basin and because of the depth of the watertable. The basin may receive some discharge from the perched watertable in the Woorinen Formation explaining the presence of water in the basin (as seen from air photos). Also, the banks protecting the Red Cliffs-Morkalla Road may have been built to protect the road from being washed out by flooding from the perched aquifer.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Site Name> RWC 8
<Synonyms> Red Cliffs 8

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

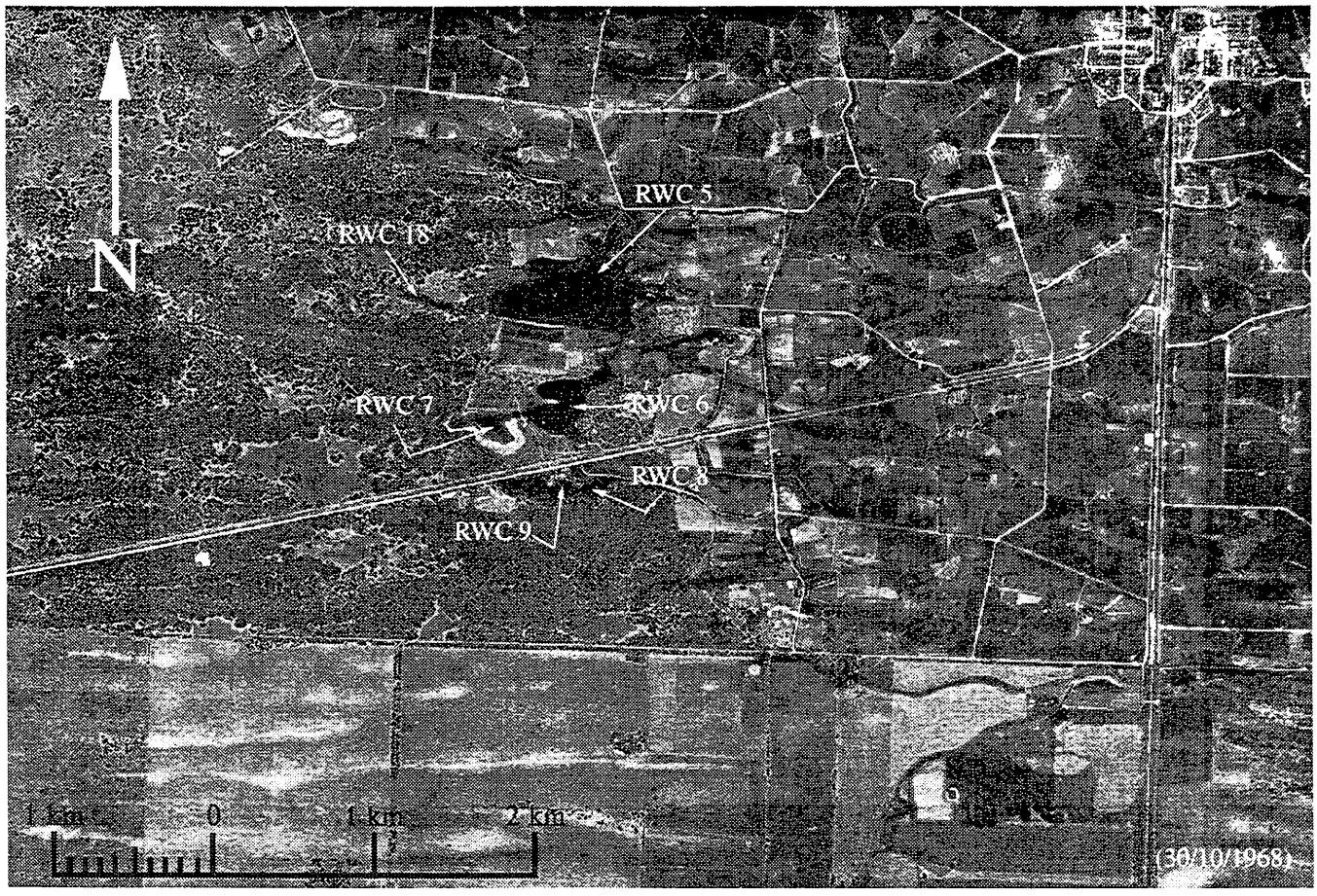
References Cited

Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
RWC 5
RWC 18
RWC 7
RWC 6
RWC 8
RWC 9
1 km
0
1 km
2 km
(30/10/1968)

<Site Name> RWC 9
<Synonyms> Red Cliff 9

Spatial

<**Location description**> 5 kilometres SW of Red Cliffs, Victoria and 5 kilometres ENE of Thurla

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 605100

<**Coordinates northing (AMG)**> 6199900

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Inactive

<**Full surface area (ha)**> 3 ha

<**Volume capacity (ML)**> 19 ML

<**Full surface level (m AHD)**> 52.22 m AHD

<**Groundwater level (m AHD)**> 37.5 m AHD

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> 1980 mm/yr Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**> Dry

<**Sources of water to be disposed**> Red Cliffs Irrigation Area

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**> No sign of having been used as a disposal basin. No outfall drain present. Natural depression.

<Site Name> RWC 9
<Synonyms> Red Cliff 9

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Red Cliffs Irrigation District

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is a small depression within the longitudinal Woorinen dunes and is surrounded by uncleared mallee. The basin is reported to be dry, but airphotos suggest that there is at least some dampness in the sand.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is on the Red Cliffs Ridge, northeast of the Wargan Fault, and southeast of the Danyo Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (5-10 m) and underlain by the Blanchetown Clay (5-10 m), the Parilla Sand (35-40 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay and silty clay; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 10 kilometres

<**Head between basin and river/tributary**>

<Site Name> RWC 9
<Synonyms> Red Cliff 9

<Direction of groundwater flow in regional aquifer> South away from the Murray River (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Blanchetown Clay: 5-10 metres; Upper Parilla Sand: 5-7 metres

<kv and kh of aquifer> Parilla Sand: Kh = 1 m/day (Linke, 1990b)

<EC of aquifer> 35,000 mg/L TDS

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 30 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin is dry and has never been used so it is difficult to estimate potential problems. The potential does exist for leakage into the Parilla Sand because of the large difference in hydraulic head and the relative thinness of the Blanchetown Clay (5-10 metres). However, any problems would be minimal because of the size of the basin and because of the depth of the watertable. The basin may receive some discharge from the perched watertable in the Woorinen Formation explaining the presence of water in the basin (as seen from air photos).

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Site Name> RWC 9
<Synonyms> Red Cliff 9

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

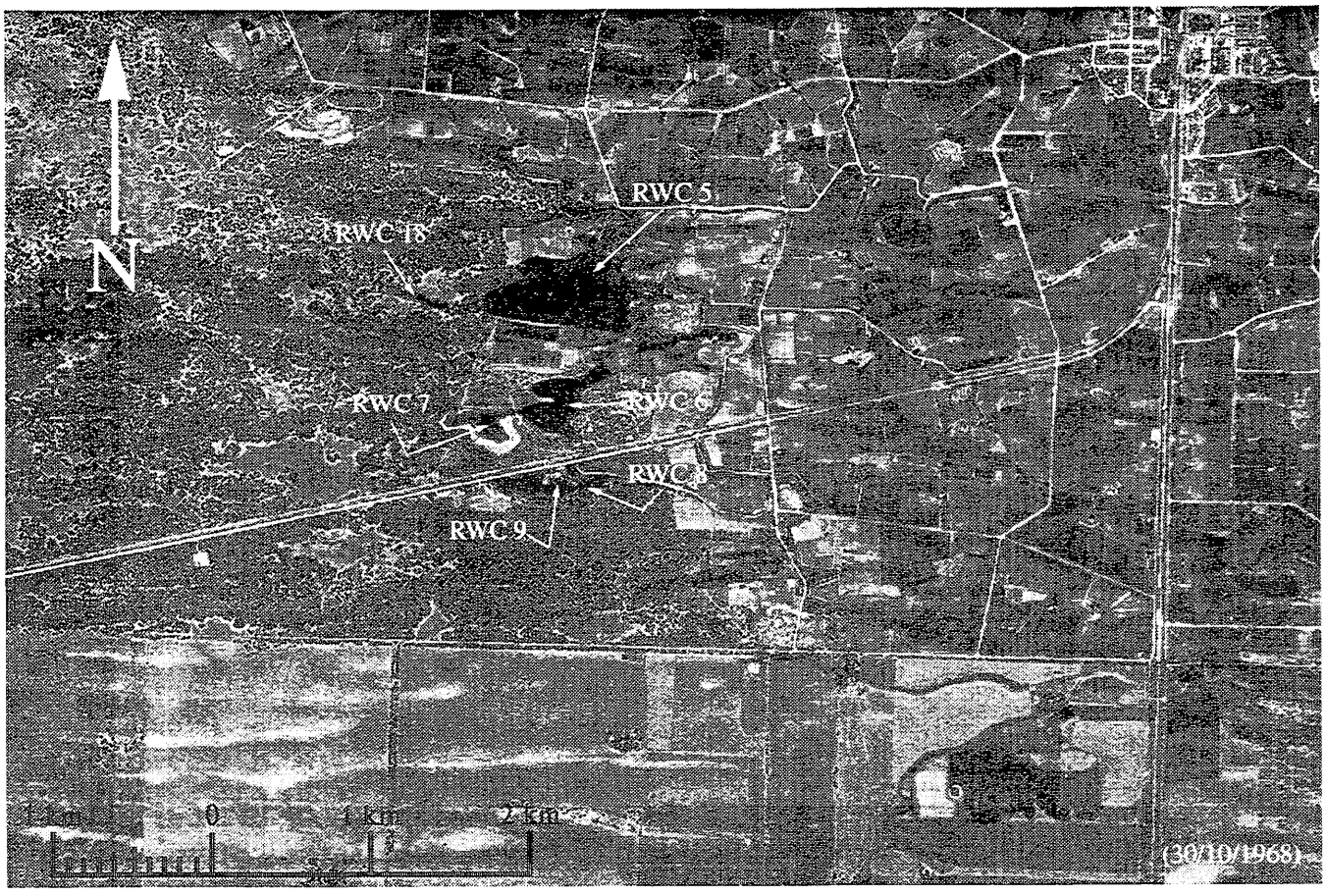
References Cited

Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
RWC 5
RWC 18
RWC 7
RWC 6
RWC 8
RWC 9
1 km
0
1 km
2 km
(30/10/1968)

<**Site Name**> RWC 12
<**Synonyms**> Red Cliffs 12

Spatial

<**Location description**> 4 kilometres NE of Red Cliffs, Victoria and 10 kilometres SSE of Mildura, Victoria

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 611400

<**Coordinates northing (AMG)**> 6206400

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 75 ha

<**Volume capacity (ML)**> 826 ML

<**Full surface level (m AHD)**> 38 m AHD

<**Groundwater level (m AHD)**> 37 m AHD

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> Inflow/evaporation > 1.5

<**Volume disposed annually (ML/yr)**> 3649 ML/yr

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**> 1500-9350 EC

<**Sources of water to be disposed**> Red Cliffs Irrigation District

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**> Permanent saline wetland created by ponding drainage water. Supports reed bed habitat and water birds. Groundwater levels within 25 cm of ground surface surrounding basin. Severe degradation of 335 ha of floodplain vegetation (RWC, 1993a).

<Site Name> RWC 12
<Synonyms> Red Cliffs 12

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Red Cliffs Irrigation District

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is a stranded meander loop of the Murray River. It is bounded on the west by the trench escarpment and on the east by the floodplain it also connected to Psyche Bend Lagoon by a channel in northeastern corner.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located on the Red Cliffs Ridge northeast of the Wargan Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Coonambidgal Formation (3-5 m), and is underlain by the Channel Sand (Monoman Formation) (10-15 m), the Parilla Sand (30 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990 and RWC bore 7688 and 7690).

<**Host formation**> Coonambidgal Formation

<**Host lithofacies**> Grey silty clays, clay, and sandy clay

<**Aquitard**> Coonambidgal Formation

<**Aquitard lithofacies**> Grey silty clays, clay, and sandy clay

<**Aquifer**> Channel Sand and Parilla Sand

<**Aquifer lithofacies**> Channel Sand: Fine to medium sand; Parilla Sand: Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 2.5 kilometres

<Site Name> RWC 12
<Synonyms> Red Cliffs 12

<Head between basin and river/tributary> 0.3-0.4 metres

<Direction of groundwater flow in regional aquifer> North towards Psyche Bend Lagoon and the Murray River (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Coonambidgal Formation: 3-5 metres

<kv and kh of aquifer> Channel Sand: Kh = 20 m/day (Linke, Gato, and Northey, 1991a); Parilla Sand: Kh = 1.6 to 58 m/day (Duncan and Linke, 1992)

<EC of aquifer> 35,000 mg/L TDS (RWC, 1993)

<Porosity of aquifer>

<Thickness of aquifer> Channel Sand: 10-15 metres; Parilla Sand: 30 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin receives discharge from the Channel Sand (and therefore the Parilla Sand) on its western margin and seeps to the river and Psyche Bend Lagoon on its eastern side. In addition to groundwater discharge the basin also receives input from FMIT mid-South drain and Red Cliffs Drains No's 1, 2, & 3/4, for a total input of 4850 ML/yr. Seepage occurs through the Coonambidgal Formation into the Channel Sand which is in direct hydraulic contact with the Murray River and the Parilla Sand. Salt and water balance equations predict that the amount of seepage equals 1700 ML/yr (1700 tonnes/yr of salt), however there is a surplus of 310 ML/yr perhaps suggesting that there is a body of higher saline water beneath the lagoon. Regardless, most of the discharge to the river is via Psyche Bend Lagoon, which is thought to cause an increase in river salinity of 2.34 EC at Morgan. The present strategy is to hold the water in RWC Basin 12 and Psyche Bend Lagoon until river levels are above 60,000 ML/yr and then dispose directly to the Murray River (Linke, Gato, and Northey, 1991a)

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> RWC 12
<Synonyms> Red Cliffs 12

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

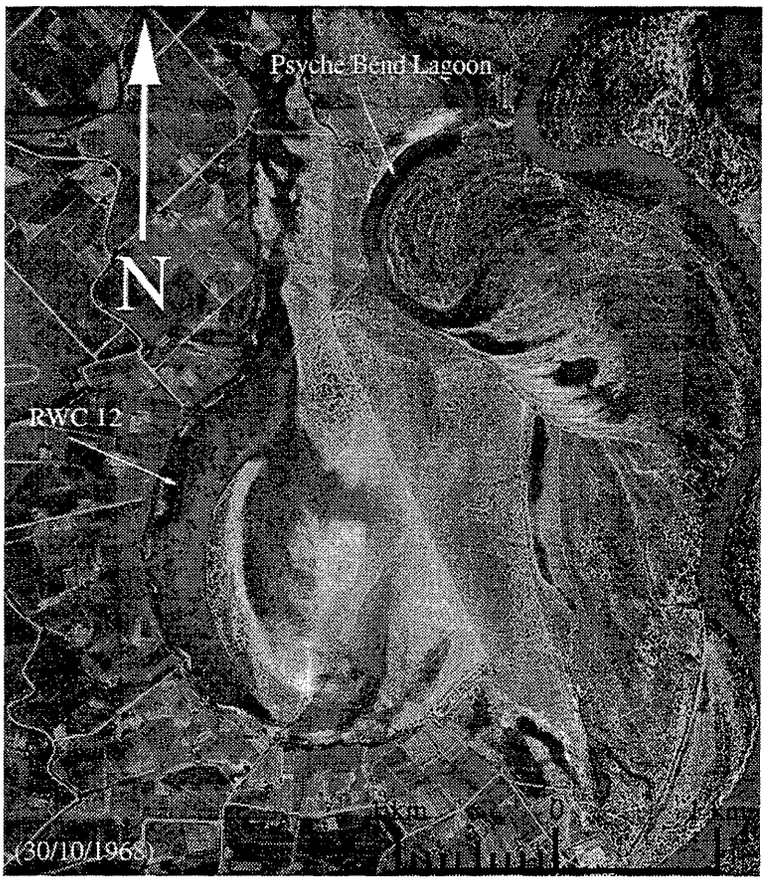
Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

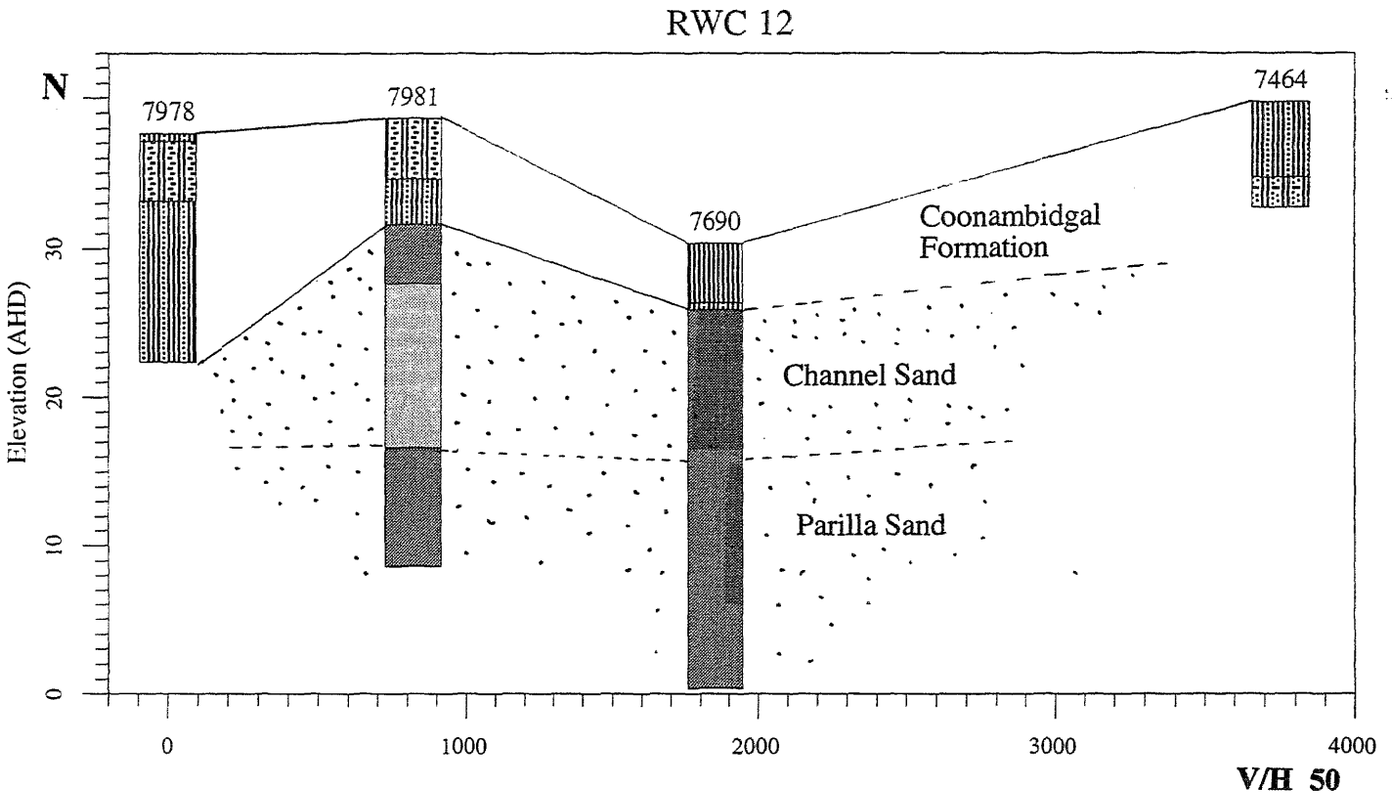
Linke, G.K., Gato, S., and Northey, P., 1991a- Evaluation of drainage disposal options for Red Cliffs: background report for Sunraysia Salinity Management Plan., Rural Water Commission of Victoria Report no. 1991/24

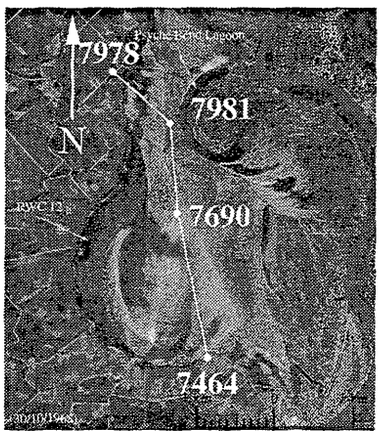
Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


Psyche Bend Lagoon
N
RWC 12
(30/10/1968)


RWC 12
N
7978
7981
7690
7464
Coonambidgal Formation
Channel Sand
Parilla Sand
Elevation (AHD)
0
10
20
30
0
1000
2000
3000
4000
V/H 50


7978
7981
7690
7464
N

<Site Name> RWC 13 (East and West)
<Synonyms> Red Cliffs 13
Cardross

Spatial

<Location description> 9 kilometres WSW of Red Cliffs, Victoria and 11 kilometres SW or Irymple, Victoria

<Located in Murray Trench> Yes

<Location 1:250 000> Mildura

<Location 1:100 000> Mildura 7329

<Zone> 54

<Coordinates easting (AMG)> 599300

<Coordinates northing (AMG)> 6201700

<State> Victoria

General

<Year begun operation>

<Active/inactive> Active

<Full surface area (ha)> 111 ha

<Volume capacity (ML)> 1374 ML

<Full surface level (m AHD)> 49.17 m AHD

<Groundwater level (m AHD)> 36.5 m AHD

<Groundwater seepage/discharge> Seepage

<Average annual evaporation> Inflow/evaporation = 0.3; 1980 mm/yr Class Pan Red Cliffs

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)> 9800 EC

<Sources of water to be disposed> Red Cliffs Irrigation Scheme

<Terminal/throughflow basin> Throughflow

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> RWC 13 (East and West)
<**Synonyms**> Red Cliffs 13
Cardross

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Red Cliffs Irrigation District

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Basin divided by bitumen road. Outfall channel to basin 14. Banks in the southeastern and northeastern necks prevent water from flooding the abutting gravel road.

Geological

<**Site description and Geomorphology**> The basin lies in the swales between the longitudinal Woorinen dunes and is elongated on an east-west axis. It is surrounded by semi-cleared and uncleared mallee.

<**Subsurface investigations at site**>

<**Structural setting**> The basin lies southwest of the Wargan Fault and southeast of the Danyo Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (5-10 m), and underlain by the Blanchetown Clay (30-32 m), the Parilla Sand (60 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay and silty clay; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Parilla Sand: Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**>

<**Site Name**> RWC 13 (East and West)
<**Synonyms**> Red Cliffs 13
Cardross

<**Head between basin and river/tributary**>

<**Direction of groundwater flow in regional aquifer**>

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**>

<**Thickness of aquitard**> Blanchetown Clay: 30-32 metres; Upper Parilla Sand: 7-10 metres

<**kv and kh of aquifer**> 1 m/day (Linke, 1990b)

<**EC of aquifer**> 10,000 mg/L TDS (RWC, 1993); 50,000 EC (Thorne, Hoxley, and Chaplin, 1990)

<**Porosity of aquifer**>

<**Thickness of aquifer**> Parilla Sand: 60 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**> The basin has only recently formed due to growth in the irrigation mound beneath Mildura (Bluml, 1992).

Interpretive 1

<**Hydraulic linkage to regional aquifer**> The amount of disposal to RWC 13 is unknown but it is either greater than 2200 ML/yr (the evaporation capacity) or there is another source of water for the basin, because the basin is usually full and at nearly constant salinity. The most likely source for the water is from the perched aquifer within the Woorinen Formation which is driven by the irrigation mound under Mildura. The flow in the perched aquifer is from the northeast which suggests that it may have passed through and have been concentrated in Lake Cardross. The water in Lake Cardross has a salinity of 4000 EC, while the water in Basin 13 has a salinity of 9800 EC suggesting that Basin 13 is sourced from the lake. Regardless of the source of the water there are at least three possibilities of why the salinities remain constant.

First, the basin may receive so much discharge from the Woorinen Formation that it overwhelms the evaporative concentration. This would indicate that the mound within the perched aquifer is growing very quickly and is not allowing the basin to come into equilibrium. Second, the basin may be acting as a throughflow basin in which the basin is a window in the perched watertable allowing little or no evaporative concentration to occur. Third, the basin may leak through the Blanchetown Clay either into the Irymple Member of the Blanchetown Clay (on top of the Upper Parilla Sand) or into the Parilla itself, so that no evaporation occurs. The permeability of the Blanchetown Clay and Upper Parilla Sand may be fractured enhanced near then basin due to the presence of the Wargan Fault thereby providing a conduit for the disposal water. Water that does enter the Parilla Sand will flow away from the river and eventually enter South Australia.

<**Hydraulic linkage to surface runoff**>

<Site Name> RWC 13 (East and West)
<Synonyms> Red Cliffs 13
Cardross

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus> Evaporation equals 2200 ML/yr (1980 mm/yr x 111 ha)

Interpretive 2

<Ranking of sustainability>

References Cited

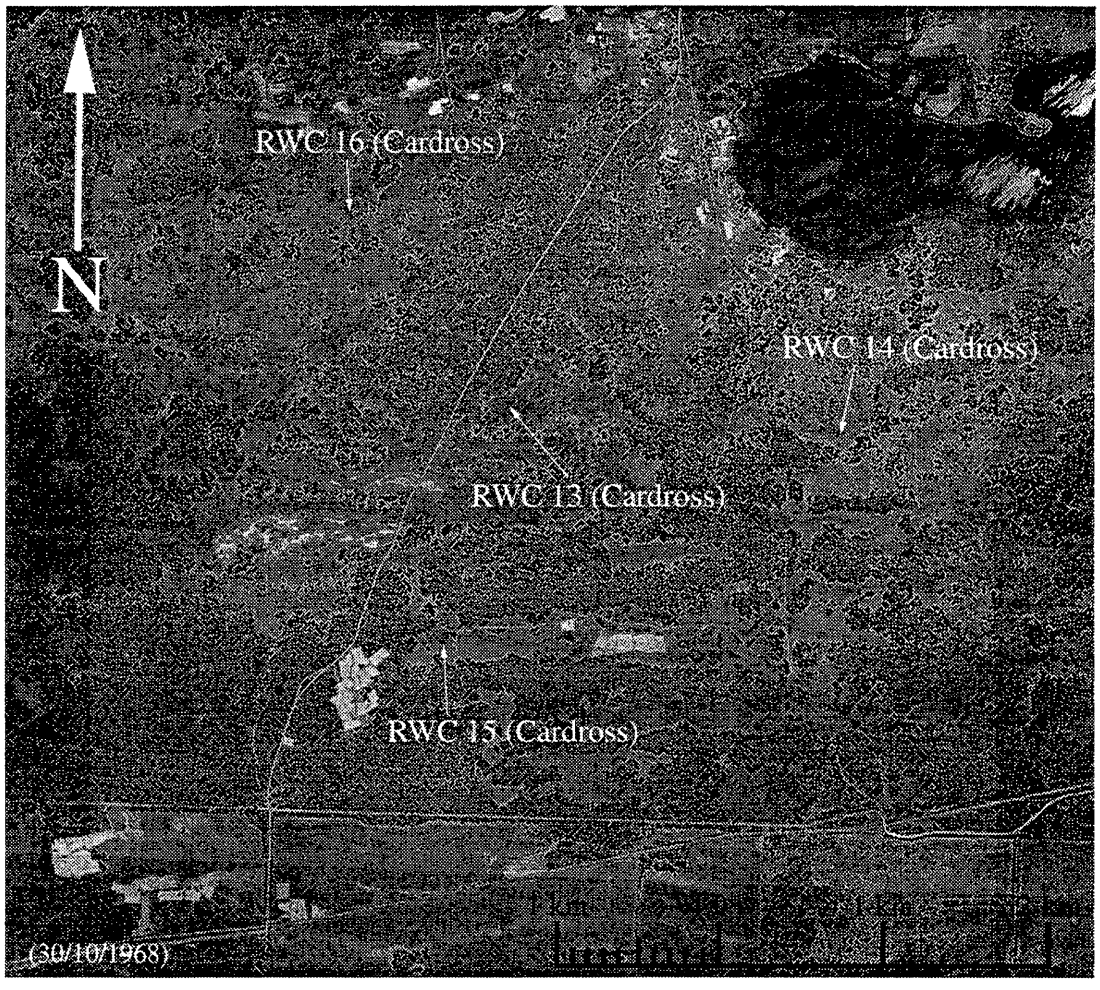
Bluml, M., 1992- Sunraysia Salinity management Plan Environment report., Dept of Conservation and Environment, ISBN 0 7306 2715 2, 103 p.

Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
RWC 16 (Cardross)
RWC 14 (Cardross)
RWC 13 (Cardross)
RWC 15 (Cardross)
(30/10/1968)

<Site Name> RWC 14
<**Synonyms**> Red Cliffs 14
Cardross

Spatial

<**Location description**> 8 kilometres WSW of Red Cliffs, Victoria and 11 kilometres SW of Irymple, Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 600700

<**Coordinates northing (AMG)**> 6201500

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 6.6 ha

<**Volume capacity (ML)**> 143 ML

<**Full surface level (m AHD)**> 49.17 m AHD

<**Groundwater level (m AHD)**> 36.5 m AHD

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> Inflow/evaporation = 0.3; 1980 mm/yr Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**> Dry

<**Sources of water to be disposed**> Red Cliffs Irrigation District

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**> For basin to operate at full capacity, it would be necessary to hold basin 13 at full capacity for a considerable period of time for water to move from outfall drain in basin 13 into basin 14.

<Site Name> RWC 14
<Synonyms> Red Cliffs 14
Cardross

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Red Cliffs Irrigation District

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Outfall connection with RWC 13

Geological

<**Site description and Geomorphology**> The basin is located in a depression among the longitudinal Woorinen Formation dunes and is connected to RWC 13 by an infall channel. The basin is usually dry and is surrounded by uncleared mallee.

<**Subsurface investigations at site**>

<**Structural setting**> The basin lies southwest of the Wargan Fault and southeast of the Danyo Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (5-10 m), and underlain by the Blanchetown Clay (30-32 m), the Parilla Sand (60 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay and silty clay; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Parilla Sand: Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 14 kilometres

<**Head between basin and river/tributary**>

<Site Name> RWC 14
<Synonyms> Red Cliffs 14
Cardross

<Direction of groundwater flow in regional aquifer> Southwest away from the Murray River (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Blanchetown Clay: 30-32 metres; Upper Parilla Sand: 7-10 metres

<kv and kh of aquifer> 1 m/day (Linke, 1990b)

<EC of aquifer> Woorinen Formation?: 10,000 mg/L TDS (RWC, 1993); Parilla Sand 50,000 EC (Thorne, Hoxley, and Chaplin, 1990)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 60 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin is currently dry and is filled from the outfall of Basin 13, only when Basin 13 is abnormally high. There is no input from the perched aquifer in the Woorinen Formation although this situation may change if the irrigation mound under Mildura continues to grow. Water from the basin will probably not affect the Parilla Sand because of the thick sequence of Blanchetown Clay and Upper Parilla Sand and because of the low volume of water that the basin receives.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus> Evaporation equals 130 ML/year (1980 mm/yr x 6.6 ha)

<Site Name> RWC 14
<Synonyms> Red Cliffs 14
Cardross

Interpretive 2

<Ranking of sustainability>

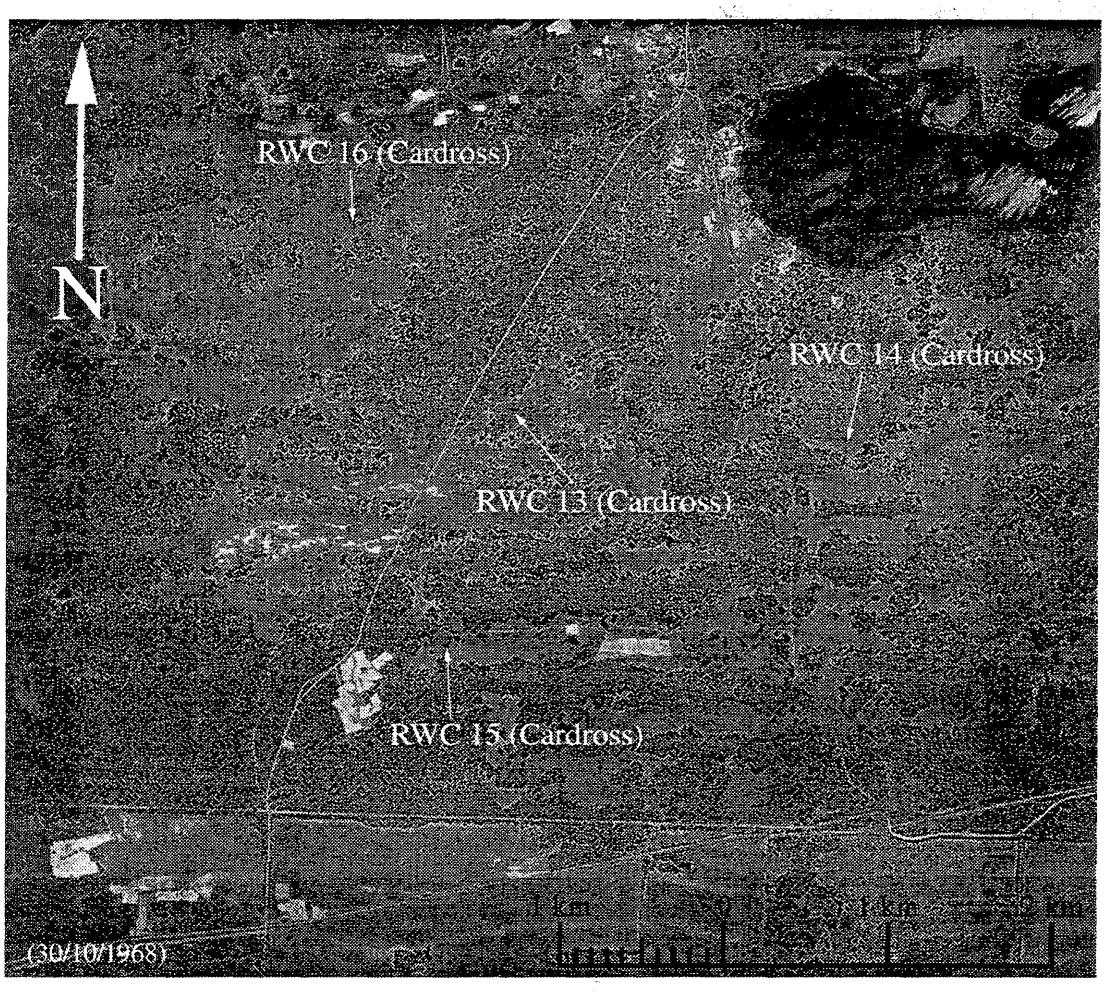
References Cited

Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
RWC 16 (Cardross)
RWC 14 (Cardross)
RWC 13 (Cardross)
RWC 15 (Cardross)
1 km
1 km
2 km
(30/10/1968)

<Site Name> RWC 15
<Synonyms> Red Cliffs 15
Cardross

Spatial]

<**Location description**> 10 kilometres WSW of Red Cliffs, Victoria and 3 kilometres WNW of Thurla, Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 598600

<**Coordinates northing (AMG)**> 6200800

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Inactive

<**Full surface area (ha)**>

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**>

<**Groundwater level (m AHD)**> ~35.8 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> 1980 mm Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**> Never used

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**> 4000 EC

<**Sources of water to be disposed**> Red Cliffs Irrigation District

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**> Never used as evaporation basin, outfall drain constructed at southeastern end of basin 13 in anticipation of usage of basin 15.

<Site Name> RWC 15
<**Synonyms**> Red Cliffs 15
Cardross

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Red Cliffs Irrigation District

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Banks have been built, bitumen road constructed through large portion of the basin, and outflow pipe from basin 13.

Geological

<**Site description and Geomorphology**> The basin is located in a depression of the longitudinal Woorinen dunes and is surrounded by partially cleared mallee.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is southwest of the Wargan Fault and southeast of the Danyo Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (5-10 m), and underlain by the Blanchetown Clay (34 m), the Parilla Sand (60 m), the Bookpurnong Beds, the Murray Group, and the Renmark group geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red sand and silt

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay and silt clay; Upper Parilla Sand: Pisolitic, ferruginous duricrust and/or clayey sand

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium grained sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> ~12 kilometres

<Site Name> RWC 15
<Synonyms> Red Cliffs 15
Cardross

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Southwest away from the river (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Blanchetown Clay: 34 metres; Upper Parilla Sand: 5-7 metres

<kv and kh of aquifer> Parilla Sand: 1 m/day (Linke, 1990b)

<EC of aquifer> Parilla Sand: 10,000 mg/L TDS (RWC, 1993); Parilla Sand: 50,000 EC (Thorne, Hoxley, and Chaplin, 1990)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 60 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin has the potential to leak into the Parilla Sand, because of the large difference between the full level (estimated) and the head in the Parilla Sand. Seepage from the basin is unknown, but it is in a similar position geologically to the Wargan Basins which Duncan and Linke (1993) estimated leak at a rate of 0.8 mm/day. Most of the seepage from the basin will probably form a perched watertable in the Woorinen Formation. The mound will grow in size until it reaches equilibrium between inflow and evaporation/ downwards seepage.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> RWC 15
<Synonyms> Red Cliffs 15
Cardross

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

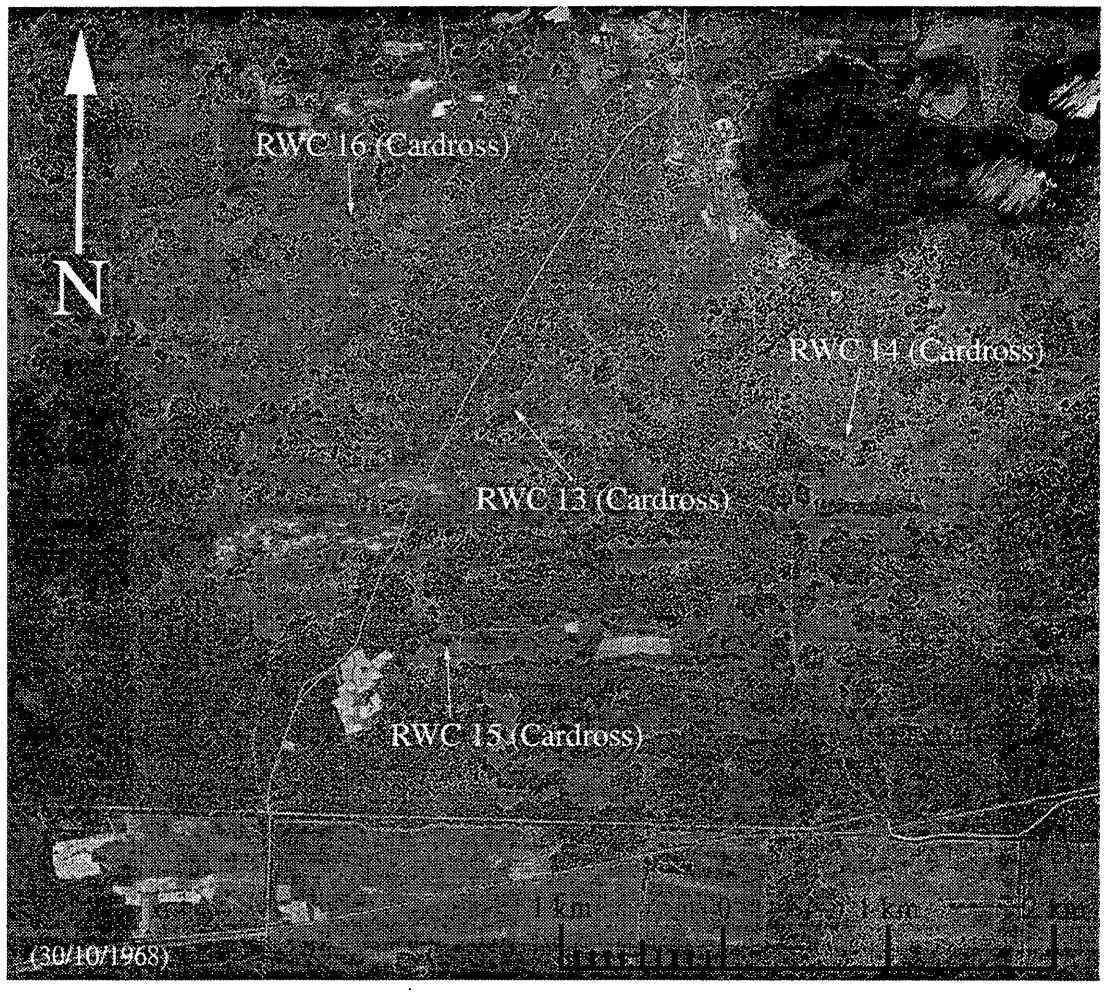
Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
RWC 16 (Cardross)
RWC 14 (Cardross)
RWC 13 (Cardross)
RWC 15 (Cardross)
1 km
0
1 km
2 km
(30/10/1968)

<Site Name> RWC 16
<Synonyms> Red Cliffs 16
Cardross

Spatial

<Location description> 12 kilometres WSW of Red Cliffs, Victoria and 19 kilometres SSW of Mildura, Victoria

<Located in Murray Trench> No

<Location 1:250 000> Mildura

<Location 1:100 000> Mildura 7329

<Zone> 54

<Coordinates easting (AMG)> 597900

<Coordinates northing (AMG)> 6202000

<State> Victoria

General

<Year begun operation>

<Active/inactive> Active

<Full surface area (ha)> 17.7 ha

<Volume capacity (ML)> 244 ML

<Full surface level (m AHD)> 49.17 m AHD

<Groundwater level (m AHD)> 36.5 m AHD

<Groundwater seepage/discharge> Seepage

<Average annual evaporation> Inflow/evaporation = 0.3

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)> Dry

<Sources of water to be disposed> Red Cliffs Irrigation District

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> RWC 16
<Synonyms> Red Cliffs 16
Cardross

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Red Cliffs Irrigation District

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Served by open channel from most westerly corner of basin 13. Between 1968 and 1972, banks were constructed in basin 16, reducing its original capacity.

Geological

<**Site description and Geomorphology**> The basin is located in a depression among the longitudinal Woorinen Formation dunes and is connected to the western most corner of RWC 13 by an open channel. The basin is dry and is surrounded by uncleared mallee.

<**Subsurface investigations at site**>

<**Structural setting**> The basin lies southwest of the Wargan Fault and southeast of the Danyo Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (5-10 m), and underlain by the Blanchetown Clay (30-32 m), the Parilla Sand (60 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay and silty clay; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Parilla Sand: Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 16.5 kilometres

<Site Name> RWC 16
<Synonyms> Red Cliffs 16
Cardross

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Southwest away from the Murray River (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Blanchetown Clay: 30-32 metres; Upper Parilla Sand: 7-10 metres

<kv and kh of aquifer> 1 m/day (Linke, 1990b)

<EC of aquifer> Woorinen Formation?: 10,000 mg/L TDS (RWC, 1993); Parilla Sand 50,000 EC (Thorne, Hoxley, and Chaplin, 1990)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 60 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin is currently dry and is filled from the outfall of Basin 13, only when Basin 13 is abnormally high. There is no input from the perched aquifer in the Woorinen Formation although this situation may change if the irrigation mound under Mildura continues to grow. Water from the basin will probably not affect the Parilla Sand because of the thick sequence of Blanchetown Clay and Upper Parilla Sand and because of the low volume of water that the basin receives.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<**Site Name**> RWC 16
<**Synonyms**> Red Cliffs 16
Cardross

<**Evaporation surplus**> Evaporation equals 130 ML/year (1980 mm/yr x 6.6 ha)

Interpretive 2

<**Ranking of sustainability**>

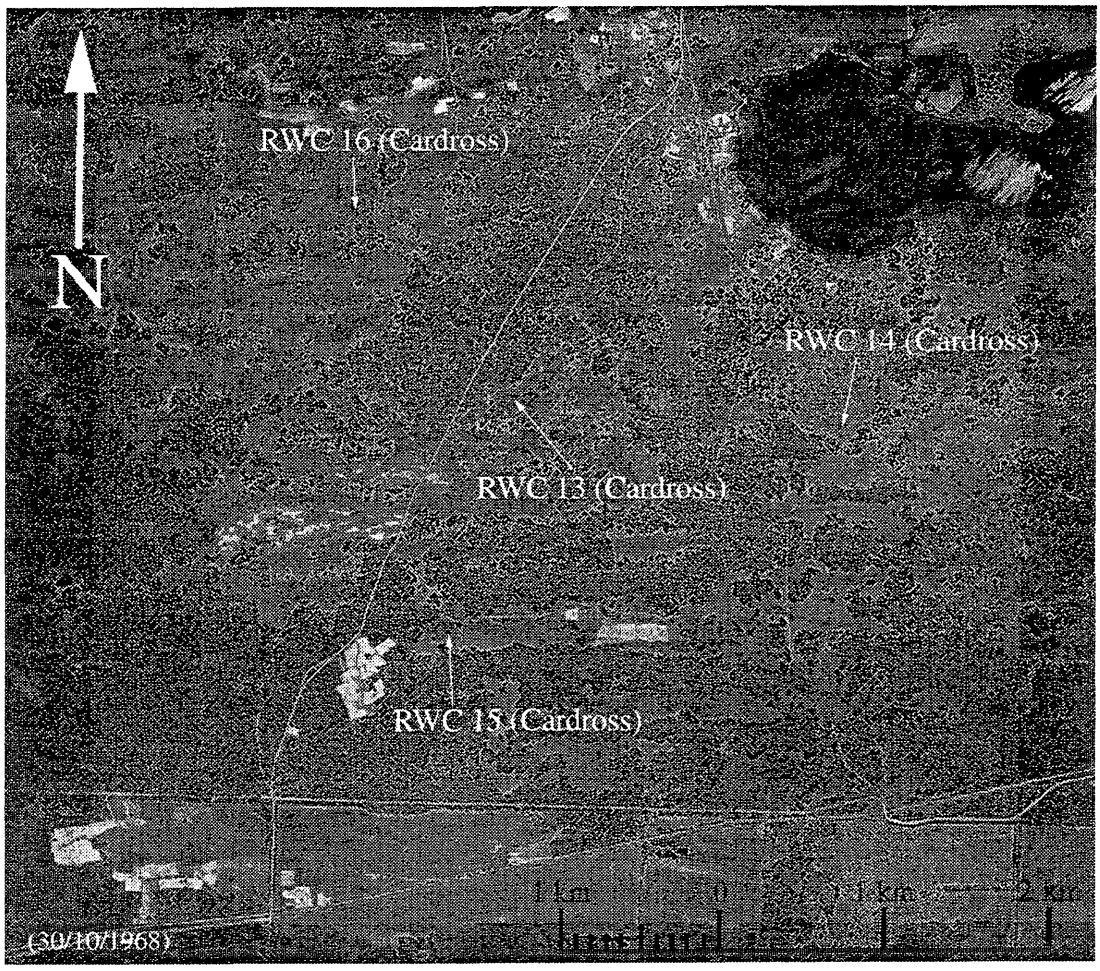
References Cited

Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
RWC 16 (Cardross)
RWC 14 (Cardross)
RWC 13 (Cardross)
RWC 15 (Cardross)
1 km
0
1 km
2 km
(30/10/1968)

<Site Name> RWC 17
<Synonyms> Red Cliffs 17

Spatial

<Location description> 8 kilometres SSW of Mildura, Victoria and 7 kilometres NW of Red Cliffs, Victoria

<Located in Murray Trench> No

<Location 1:250 000> Mildura

<Location 1:100 000> Mildura 7329

<Zone> 54

<Coordinates easting (AMG)> 604500

<Coordinates northing (AMG)> 6208200

<State> Victoria

General

<Year begun operation>

<Active/inactive> Active

<Full surface area (ha)> 10 ha

<Volume capacity (ML)> 40 ML

<Full surface level (m AHD)> 55.60 m AHD

<Groundwater level (m AHD)> 40.5 m AHD

<Groundwater seepage/discharge> Seepage

<Average annual evaporation> 1980 mm/yr Class A pan Red Cliffs

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)> Dry

<Sources of water to be disposed>Red Cliffs Irrigation District

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> RWC 17
<Synonyms> Red Cliffs 17

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Red Cliffs Irrigation District

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Banks have been built

Geological

<**Site description and Geomorphology**> The basin is located within the longitudinal Woorinen dunes and is bounded by agricultural land to the south and semi-cleared mallee to the north.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located northeast of the Wargan Fault and southeast of the Danyo Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (5 m), and underlain by the Blanchetown Clay (5 m), the Parilla Sand (38 m), the Bookpurnong beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Linke, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay and silty clay; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine and medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 11.5 kilometres

<Site Name> RWC 17
<Synonyms> Red Cliffs 17

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> South away from the Murray River (RWC, 1991)

<kv of artificial floor>

<kv and kh of host> Woorinen Formation: Kh = 40-50 m/day (Transmissivity 190 m^2/day (SR&WSC, 1974)

<kv and kh of aquitard>

<Thickness of aquitard> Blanchetown Clay: 5 metres; Upper Parilla Sand; 5-7 metres

<kv and kh of aquifer> Parilla Sand: Kh = 1.6 to 58 m/day (Duncan and Linke, 1992)

<EC of aquifer> > 50,000 mg/L TDS

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 30 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin has the potential to leak into the Parilla Sand because its full level is 15 metres higher than the potentiometric surface of the Parilla and because the Blanchetown Clay thins towards the Red Cliffs Ridge. There is probably little or no discharge from the perched aquifer (Woorinen Formation) because the basin is higher than the potentiometric head in the irrigation mound and because the basin is dry (evaporation greater than inflow).

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Site Name> RWC 17
<**Synonyms**> Red Cliffs 17

<**Evaporation surplus**> Evaporation capacity 198 ML/yr (10 ha x 1980 mm/yr evaporation)

Interpretive 2

<**Ranking of sustainability**>

References Cited

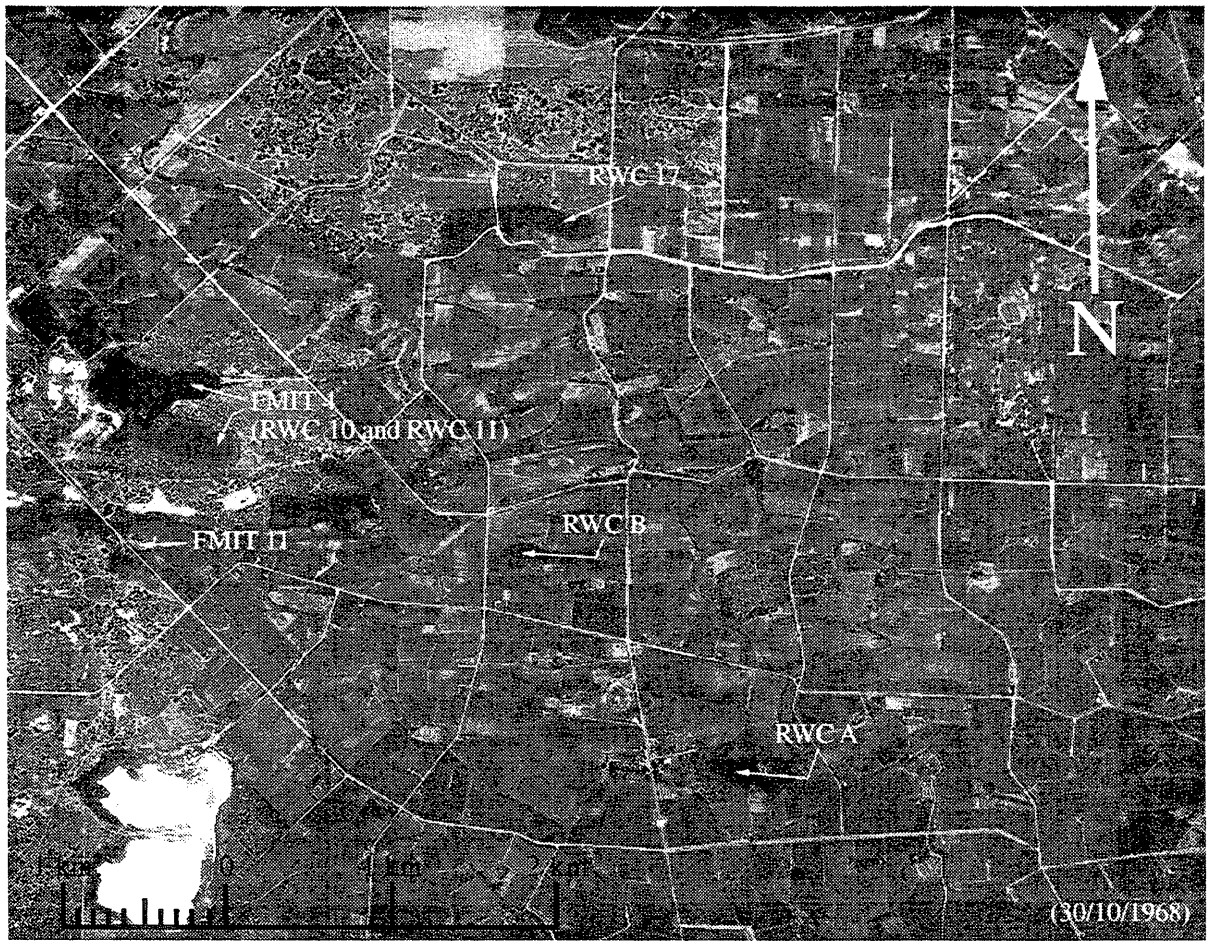
Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

State Rivers and Water Supply Commission, Victoria (SR&WSC), 1974- Sunraysia Salinity Investigations., Unpublished report

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


RWC 17
N
EMIT N
(RWC 10 and RWC 11)
EMIT 11
RWC B
RWC A
1 Km
0
1 Km
2 Km
(30/10/1968)

<Site Name> RWC 18
<Synonyms> Red Cliffs 18

Spatial

<**Location description**> 5 kilometres WSW of Red Cliffs, Victoria and 11 kilometres SSW of Irymple, Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 604000

<**Coordinates northing (AMG)**> 6201300

<**State**> Victoria

General

<**Year begun operation**> 1972

<**Active/inactive**> Active

<**Full surface area (ha)**> 40.0 ha

<**Volume capacity (ML)**> 380 ML

<**Full surface level (m AHD)**> 50.08 m AHD

<**Groundwater level (m AHD)**> 38 m AHD

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> Inflow/evaporation = 0.3; 1980 mm/yr Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**> Dry

<**Sources of water to be disposed**> Red Cliffs Irrigation District

<**Terminal/throughflow basin**> Throughflow

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> RWC 18
<Synonyms> Red Cliffs 18

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Red Cliffs Irrigation District

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Works have been undertaken to excavate an outfall channel from the basin. Culvert constructed under a track in the neck separating main holding areas of basin. Connected to RWC 5 by a diversion channel.

Geological

<**Site description and Geomorphology**> The basin consists of two smaller intrabasins located in a depression within the Woorinen dunes separated by a neck of Woorinen Sand. It is surrounded by uncleared mallee and appears to be dry.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is on the Red Cliffs Ridge, northeast of the Wargan Fault, and southeast of the Danyo Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (5-10 m), and underlain by the Parilla Sand (35 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Upper Parilla Sand

<**Aquitard lithofacies**> Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 11 kilometres

<Site Name> RWC 18
<Synonyms> Red Cliffs 18

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> South away from the River Murray (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Upper Parilla Sand: 5-7 metres

<kv and kh of aquifer> Parilla Sand: Kh = 1 m/day (Linke, 1990b)

<EC of aquifer> > 50,000 mg/L TDS (RWC, 1993)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 25-30 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin is currently dry, however it has the potential to leak into the Parilla Sand aquifer because of the difference in the full level and the potentiometric surface of the Parilla and because of the absence of the Blanchetown Clay. However, there is probably little seepage at present because the evaporation capacity (792 ML/yr) is much higher than the inflow to the basin.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> RWC 18
<**Synonyms**> Red Cliffs 18

<**Category - degree of hydraulic isolation**>

<**Evaporation surplus**> Evaporation equals 792 ML/yr (1980 mm/yr x 40 ha)

Interpretive 2

<**Ranking of sustainability**>

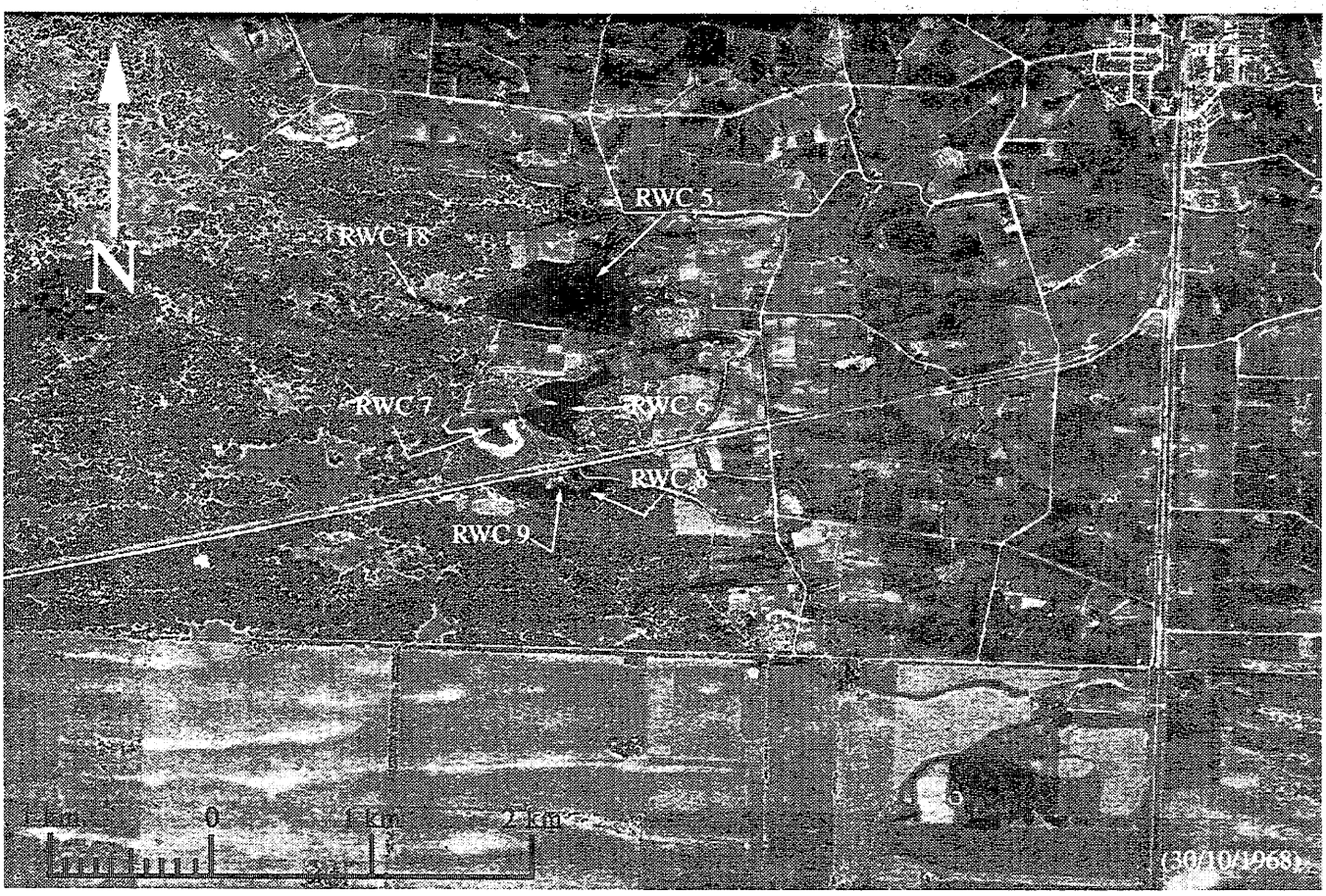
References Cited

Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
RWC 5
RWC 18
RWC 7
RWC 6
RWC 8
RWC 9
1 km
0
1 km
2 km
(30/10/1968)

<Site Name> RWC A
<**Synonyms**> Red Cliffs A

Spatial

<**Location description**> 4 kilometres WNW of Red Cliffs, Victoria and 10 kilometres south of Mildura, Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 605800

<**Coordinates northing (AMG)**> 6205100

<**State**> Victoria

General

<**Year begun operation**> 1949

<**Active/inactive**> Inactive

<**Full surface area (ha)**> 3.3 ha

<**Volume capacity (ML)**> 10 ML

<**Full surface level (m AHD)**> 51.91 m AHD

<**Groundwater level (m AHD)**> 39.5 m AHD

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> Inflow/evaporation > 1.5; 1980 mm/yr Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**> 363 ML/yr

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**>

<**Sources of water to be disposed**> Red Cliffs Irrigation District

<**Terminal/throughflow basin**> Throughflow

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> RWC A
<Synonyms> Red Cliffs A

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Red Cliffs Irrigation District

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is located within a larger oval shaped depression that is ringed by a ridge of Blanchetown Clay? capped by the Woorinen Formation. The surface of the basin is lower (deflation?) and is covered by Woorinen Formation dunes that also controls the geometry and placement of the basin. The area is currently being used for agricultural purposes.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is northeast of the Wargan Fault, northwest of the Red Cliffs Ridge, and southeast of the Danyo Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (2 m), and is underlain by the Parilla Sand (35 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Upper Parilla Sand

<**Aquitard lithofacies**> Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 8.5 kilometres

<Site Name> RWC A
<Synonyms> Red Cliffs A

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> South away from the Murray River (RWC, 1991)

<kv of artificial floor>

<kv and kh of host> Woorinen Formation: Kh = 40-50 m/day (Transmissivity 190 m^2/day (SR&WSC, 1974))

<kv and kh of aquitard>

<Thickness of aquitard> Upper Parilla Sand: 5-7 metres

<kv and kh of aquifer> Parilla Sand: Kh = 1.6 to 58 m/day (Duncan and Linke, 1992)

<EC of aquifer> >50,000 mg/L TDS (RWC, 1993)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 30 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The area around the basin appears to have been a deflation basin during periods of higher water levels. The deflation basin has eroded though the thin layer of Blanchetown Clay and now sits on the Upper Parilla Sand. The deflation basin is different from others in the area because the watertable within the Parilla Sand is 10 metres below the basin floor (instead of at the surface) and the amount of deflation is only 5-10 metres (instead of 15-20 metres). There are at least two possible scenarios to explain the development of the basin. First, the basin may have formed due to flow within the perched aquifer that collected within an existing depression that subsequently deflated through the Blanchetown Clay (as the water evaporated) until the present basin formed. Second, the basin may have formed due to higher levels of groundwater (than present) in the Parilla Sand that discharged over the Blanchetown Clay causing deflation. The high groundwater level in the Parilla Sand (10 metres higher than the irrigation mound levels) may be associated with a higher river level (before present incision?), activation of the Wargan Fault (and backup of flow in the Parilla Sand), a wetter climate, or a combination of factors.

The presence of the deflation basin means that the disposal basin sits directly upon the Upper Parilla Sand aquitard which in combination with the 10 metre difference if the full level of the basin and the potentiometric surface of the Parilla Sand could allow seepage from the basin. Current disposal to the basin is 363 ML/yr while the evaporation rate is 66 ML/yr, suggesting that water levels are being maintained by accession of disposal water into the Parilla Sand. Once in the Parilla Sand the groundwater will move southwards away from the Murray River where it will eventually head west into South Australia.

<Site Name> RWC A
<Synonyms> Red Cliffs A

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus> Evaporation capacity 66 ML/yr (3.3 ha x 1990 mm/yr evaporation) while inflow equals 363 ML/yr (RWC, 1993)

Interpretive 2

<Ranking of sustainability>

References Cited

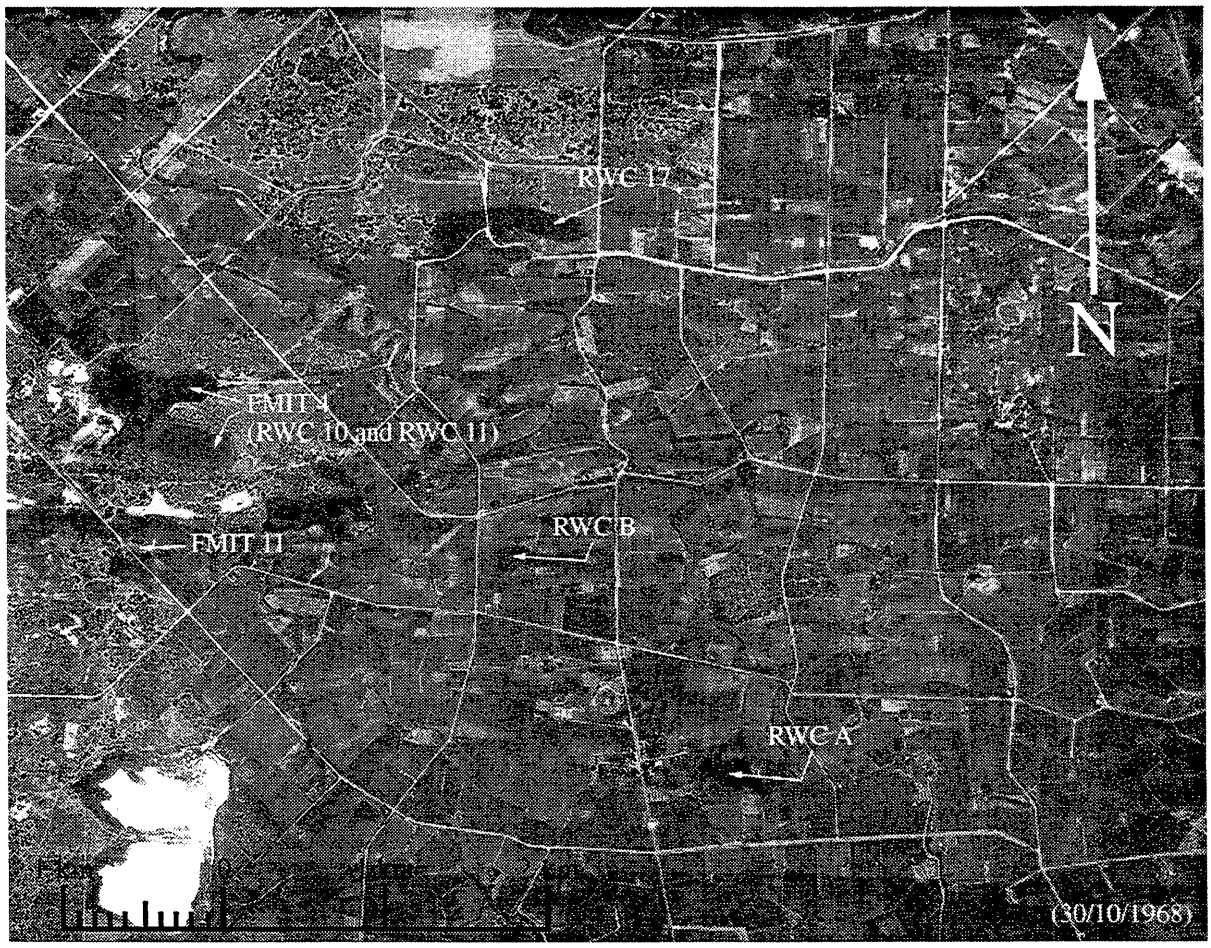
Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

State Rivers and Water Supply Commission, Victoria (SR&WSC), 1974- Sunraysia Salinity Investigations., Unpublished report

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


RWC 17
N
FMIT 4
(RWC 10 and RWC 11)
FMIT 11
RWC B
RWC A
(30/10/1968)

<Site Name> RWC B
<Synonyms> Red Cliffs B

Spatial

<**Location description**> 10 kilometres SSW of Mildura, Victoria and 5 kilometres NW of Red Cliffs Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 604700

<**Coordinates northing (AMG)**> 6206300

<**State**> Victoria

General

<**Year begun operation**> 1950

<**Active/inactive**> Inactive

<**Full surface area (ha)**> 4.1 ha

<**Volume capacity (ML)**> 9.1 ML

<**Full surface level (m AHD)**> 47.64 m AHD

<**Groundwater level (m AHD)**> 39.5 m AHD

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> Inflow/evaporation > 1.5; 1980 mm/yr Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**> 109 ML/yr

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**> Dry

<**Sources of water to be disposed**> Red Cliffs Irrigation District

<**Terminal/throughflow basin**> Throughflow

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**> Temporary holding basin. Mainly grass and sparse clumps of spiny rush.

<Site Name> RWC B
<Synonyms> Red Cliffs B

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Red Cliffs Irrigation District

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**>Concrete channel traverses entire length of Basin B from laterals 3A, 3B, and 3C into lateral 3.

Geological

<**Site description and Geomorphology**> The basin is located within a larger oval shaped depression that is ringed by a ridge of Blanchetown Clay? capped by the Woorinen Formation. The surface of the basin is lower (deflation?) and is covered by Woorinen Formation dunes, that also controls the geometry and placement of the basin. The area is currently being used for agricultural purposes.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is northeast of the Wargan Fault, northwest of the Red Cliffs Ridge, and southeast of the Danyo Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (2 m), and is underlain by the Parilla Sand (35 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Upper Parilla Sand

<**Aquitard lithofacies**> Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 10 kilometres

<Site Name> RWC B
<Synonyms> Red Cliffs B

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> South away from the Murray River (RWC, 1991)

<kv of artificial floor>

<kv and kh of host> Woorinen Formation: Kh = 40-50 m/day (Transmissivity 190 m^2/day (SR&WSC, 1974)

<kv and kh of aquitard>

<Thickness of aquitard> Upper Parilla Sand: 3-5 metres

<kv and kh of aquifer> Parilla Sand: Kh = 1.6 to 58 m/day (Duncan and Linke, 1992)

<EC of aquifer> >50,000 mg/L TDS (RWC, 1993)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 30 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The area around the basin appears to have been a deflation basin during periods of higher water levels. The deflation basin has eroded though the thin layer of Blanchetown Clay and now sits on the Upper Parilla Sand. The deflation basin is different from others in the area, because the watertable within the Parilla Sand is 8 metres below the basin floor (instead of at the surface) and the amount of deflation is only 5-10 metres (instead of 15-20 metres). There are at least two possible scenarios to explain the development of the basin. First, the basin may have formed due to flow within the perched aquifer that collected within an existing depression, and subsequently caused deflation through the Blanchetown Clay (as the water evaporated) until the present basin formed. Second, the basin may have formed due to higher levels of water (than present) in the Parilla Sand that discharged over the Blanchetown Clay causing deflation. The high groundwater levels in the Parilla Sand (10 metres higher than the irrigation mound levels) may be associated with a higher river level (before present incision?), activation of the Wargan Fault (and backup of flow in the Parilla Sand), a wetter climate, or a combination of factors.

The presence of the deflation basin means that the disposal basin sits directly upon the Upper Parilla Sand aquitard, which in combination with the 8 metre difference of the full level of the basin and the potentiometric surface of the Parilla Sand, could allow seepage from the basin. Current disposal to the basin is 109 ML/yr while the evaporation rate is 80 ML/yr, suggesting that water levels are being maintained by accession of disposal water into the Parilla Sand. Once in the Parilla Sand, the groundwater will move southwards away from the Murray River where it will eventually head west into South Australia.

<Hydraulic linkage to surface runoff>

<Site Name> RWC B
<Synonyms> Red Cliffs B

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus> Evaporation capacity 80 ML/yr (4.1 ha x 1990 mm/yr evaporation) while inflow equals 109 ML/yr (RWC, 1993)

Interpretive 2

<Ranking of sustainability>

References Cited

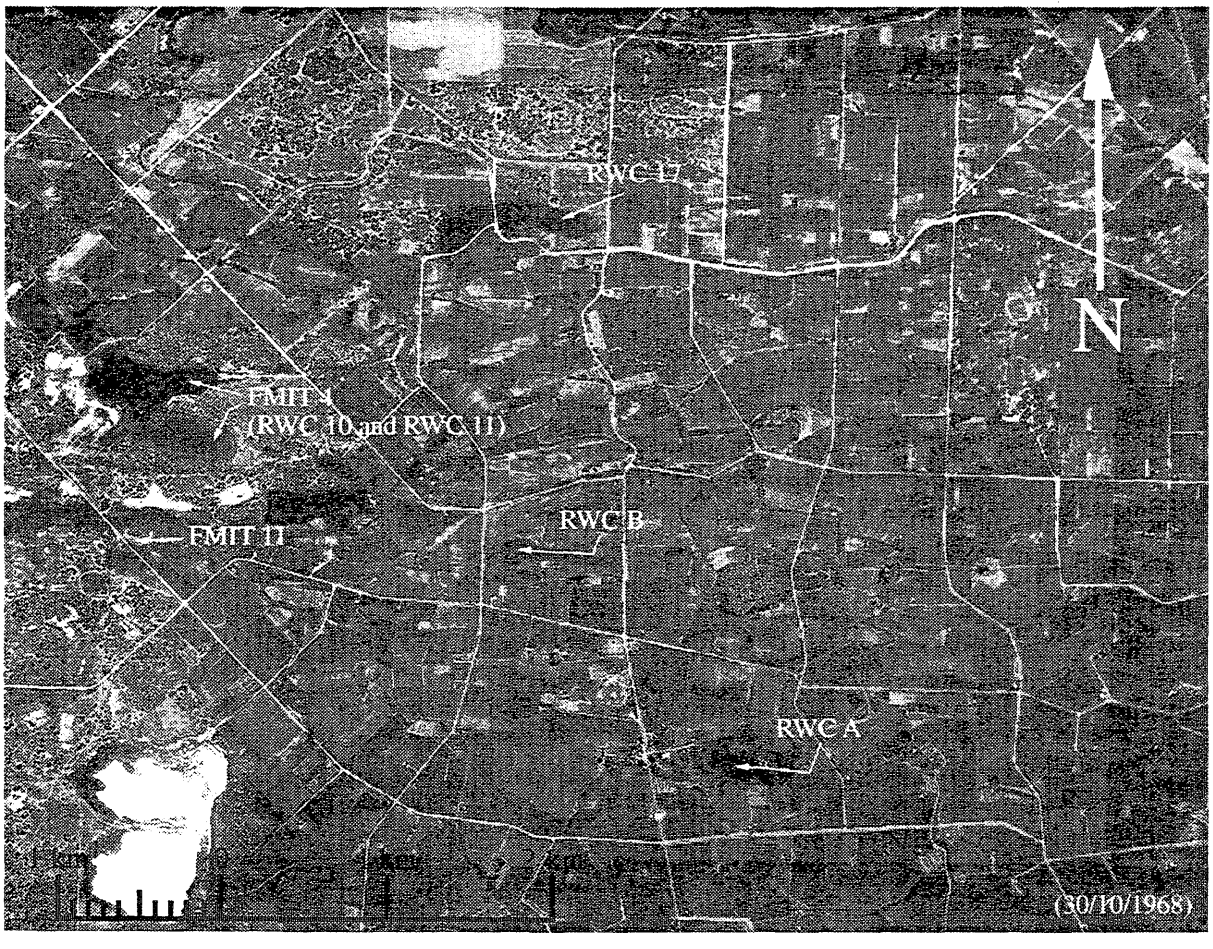
Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

State Rivers and Water Supply Commission, Victoria (SR&WSC), 1974- Sunraysia Salinity Investigations., Unpublished report

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


RWC 17
N
FMIT 4
(RWC 10 and RWC 11)
FMIT 11
RWC B
RWC A
(30/10/1968)

<Site Name> RWC C, D, and E
<Synonyms> Red Cliffs C, D, and E
Cardross

Spatial

<**Location description**> 6 kilometres WNW of Red Cliffs, Victoria and 13 kilometres SSW of Mildura, Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 602500

<**Coordinates northing (AMG)**> 6204900

<**State**> Victoria

General

<**Year begun operation**> 1963

<**Active/inactive**> Active

<**Full surface area (ha)**> 95 ha

<**Volume capacity (ML)**> 2600 ML

<**Full surface level (m AHD)**> 41.4 m AHD

<**Groundwater level (m AHD)**> 39.5 m AHD (RWC, 1991); Parilla Sand: 38.8 to 39/5 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> Inflow/evaporation = 0.3

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**> 2540 mg/L TDS

<**Range of salinity in basin (EC)**>

<**Sources of water to be disposed**> Red Cliffs Irrigation District

<**Terminal/throughflow basin**> Throughflow

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**> Drains into RWC 1, also aerial photographs have revealed that Basins C, D, and E are acting as one basin.

<Site Name> RWC C, D, and E
<**Synonyms**> Red Cliffs C, D, and E
Cardross

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Red Cliffs Irrigation District

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin consists of RWC C, RWC D, and RWC E which have coalesced into a one large basin due to an increase in discharge to the basin. The intrabasins are located in depressions within the longitudinal Woorinen dunes. The Woorinen dunes appear to be less distinct in the area, possibly suggesting erosion or deflation of the Woorinen Formation connected to the Wargan Fault or groundwater discharge.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is northeast of the Wargan Fault, southeast of the Danyo Fault, and northwest of the Red Cliffs Ridge (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (3-5 m), and is underlain by the Blanchetown Clay (10 m), the Parilla Sand (35-40 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay and silty clay; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Parilla Sand: Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 13 kilometres

<**Head between basin and river/tributary**>

<**Direction of groundwater flow in regional aquifer**> Southwest away from the Murray River

<Site Name> RWC C, D, and E
<Synonyms> Red Cliffs C, D, and E
Cardross

(RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Blanchetown Clay: 10 metres; Upper Parilla Sand: 5-7 metres

<kv and kh of aquifer> Parilla Sand: Kh = 1 m/day (Linke, 1990b)

<EC of aquifer> Parilla Sand?: 50,000 mg/L TDS (RWC, 1993)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 30-35 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The present RWC Basin C began as three individual basins (RWC C, RWC D, and RWC E) that have recently coalesced into a large basin with low salinity (2640 mg/L TDS). The amount of disposal is unknown, but it would have to be significantly higher than the evaporation capacity (1900 ML/yr) to maintain the high levels and constant salinities. Most likely, the basin recieves large volumes of groundwater (via the perched aquifer within the Woorinen Formation) from the irrigation mound in the Mildura area. If the basin is receiving groundwater discharge from the Woorinen formation there are at least three possibilities of why the salinity of the basin remains low. First, the basin may receive so much discharge from the Woorinen Formation that it overwhelms the evaporative concentration. This would indicate that the mound within the perched aquifer is growing very quickly, and is not allowing the basin to come into equilibrium. Second, the basin may be acting as a throughflow basin in which the basin is a window in the perched watertable allowing little or no evaporative concentration to occur. Third, the basin may leak through the Blanchetown Clay, either into the Irymple Member of the Blanchetown Clay (on top of the Upper Parilla Sand) or into the Parilla itself. The permeability of the Blanchetown Clay and Upper Parilla Sand may be fractured enhanced under then basin due to the presence of the Wargan Fault, thereby providing a conduit for the disposal water. Water that does enter the Parilla Sand will flow away from the river and eventually enter South Australia.

Comparison of Basin C (2640 mg/L), Basin 1 (4000 mg/L), and Basin 13 (9800 mg/l) (which are located in a line trending northeast to southwest) shows that the salinity within the basins increases towards the southwest, as would be expected in a throughflow basin. This is because every time the water comes to the surface it will be concentrated more and more getting progressively saltier to the southwest (the direction of flow). Where the water disappears to after Basin 13 is still unknown. It could either enter the Parilla Sand through the Blanchetown Clay or the mound may not have grown sufficiently to intersect Basin 15 (next in line).

<Hydraulic linkage to surface runoff>

<Site Name> RWC C, D, and E
<Synonyms> Red Cliffs C, D, and E
Cardross

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus> The evaporation capacity of the basin is 1881 ML/yr (1980 mm/yr x 95 ha)

Interpretive 2

<Ranking of sustainability>

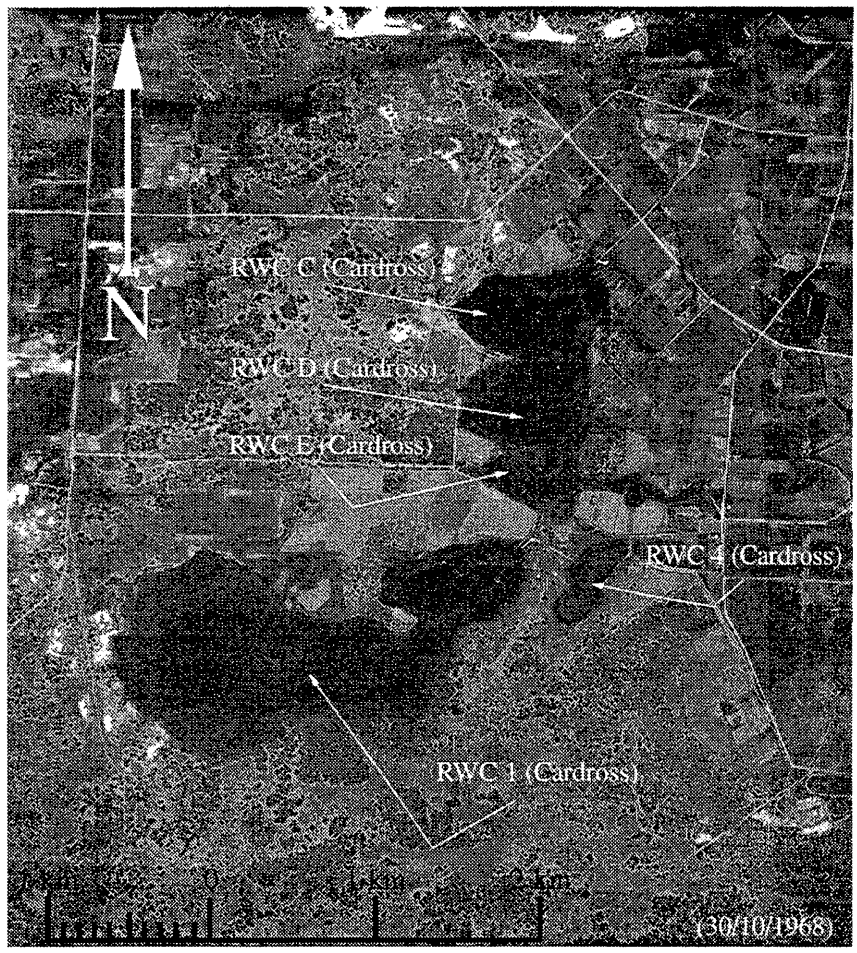
References Cited

Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
RWC C (Cardross)
RWC D (Cardross)
RWC E (Cardross)
RWC 4 (Cardross)
RWC 1 (Cardross)
1 Km
0
1 Km
2 Km
(30/10/1968)

<Site Name> South East Drainage Basin
<Synonyms> RWC South East
Bottle Bend

Spatial

<Location description> 1 kilometre west of Karadoc, Victoria and 6 kilometres SSE of Red Cliffs, Victoria

<Located in Murray Trench> Yes

<Location 1:250 000> Mildura

<Location 1:100 000> Mildura 7329

<Zone> 54

<Coordinates easting (AMG)> 615200

<Coordinates northing (AMG)> 6200100

<State> Victoria

General

<Year begun operation>

<Active/inactive> Active

<Full surface area (ha)> 2 basins North: 45 ha; South 90 ha (Linke, 1990)

<Volume capacity (ML)> 468 ML

<Full surface level (m AHD)> 37.7 m AHD

<Groundwater level (m AHD)> 37 m AHD

<Groundwater seepage/discharge> Discharge

<Average annual evaporation> Inflow/evaporation > 1.5

<Volume disposed annually (ML/yr)> 2316 ML/yr + 65 ML/yr groundwater seepage

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)> 2190 mg/L TDS

<Sources of water to be disposed> Red Cliffs Irrigation District; seepage from Carwarp Channel, groundwater flow (Linke, 1989)

<Terminal/throughflow basin> Terminal; Flooding by river (38 m AHD) at 85,000 ML/day (1 in 7 year flood)

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> South East Drainage Basin
<Synonyms> RWC South East
Bottle Bend

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Red Cliffs Irrigation District

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is a stranded meander loop of the Murray River, that is bounded on the west by the trench escarpment and on the east by the floodplain. It consists of two basins separated by a high in the floodplain with the south basin trending east-west and the north basin trending north-south.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located northwest of the Karadoc Trough, southeast of the Red Cliffs Ridge, and northeast of the Wargan Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Coonambidgal Formation (8 m), and is underlain by the Channel Sand (Monoman Formation) (3 m), the Parilla Sand (40 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990; and Linke, 1989).

<**Host formation**> Coonambidgal Formation

<**Host lithofacies**> Grey clays, silts and silty clays

<**Aquitard**> Coonambidgal Formation and Upper Parilla Sand

<**Aquitard lithofacies**> Coonambidgal Formation: Grey clays, silts and silty clays; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Channel Sand and Parilla Sand

<**Aquifer lithofacies**> Channel Sand and Parilla Sand: Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> < 500 metres

<Site Name> South East Drainage Basin
<Synonyms> RWC South East
Bottle Bend

<**Head between basin and river/tributary**> 3 metres (Linke, 1989)

<**Direction of groundwater flow in regional aquifer**> Northeast towards the Murray River (RWC, 1991)

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**>

<**Thickness of aquitard**> Coonambidgal Formation: 5-8 metres; Upper Parilla Sand: 5-7 metres

<**kv and kh of aquifer**> Channel Sand: Kh = 10 m/day (Linke, 1989); Parilla Sand: Kh = 1 m/day (Linke, 1989)

<**EC of aquifer**> 10,000 mg/L TDS (RWC, 1993); Parilla Sand: 50,000 EC, Channel Sand: 5000 EC (Linke, 1989)

<**Porosity of aquifer**>

<**Thickness of aquifer**> Channel Sand: 3 metres; Parilla Sand: 35 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**> To the west the Parilla is confined by the Blanchetown Clay, at the trench margins the shallow aquifer has head 0.8 metres above Parilla Sand, close to the river the Channel Sand is in contact with the Parilla Sand.

Interpretive 1

<**Hydraulic linkage to regional aquifer**> The basin receives discharge from the west (escarpment) and seeps into the Channel Sand (and thus into the river) through the Coonambidgal Formation in the east. The salinity of the basin is low (2316 mg/L TDS) which suggests that it mainly receives input from irrigation disposal water (both from drains and from the Parilla/Channel Sand). It also suggests that water is seeping from the basin at a fairly rapid rate as well, in order to maintain salt and water balance in the basin (Linke, 1989). The amount of seepage is unknown, but it should be on the order of 2000 ML/yr (close to amount of input). However the effect of discharge (and/or river flushing) to the Murray River is thought to be less than the Psyche Lagoon System, because the SE Basin receives low salinity groundwater (5000-10,000 EC), compared to Psyche Bend Lagoon (50,000 mg/L TDS) (Linke, Gato, and Northey, 1991a).

<**Hydraulic linkage to surface runoff**>

<**Category - hydraulic stability**>

<Site Name> South East Drainage Basin
<Synonyms> RWC South East
Bottle Bend

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

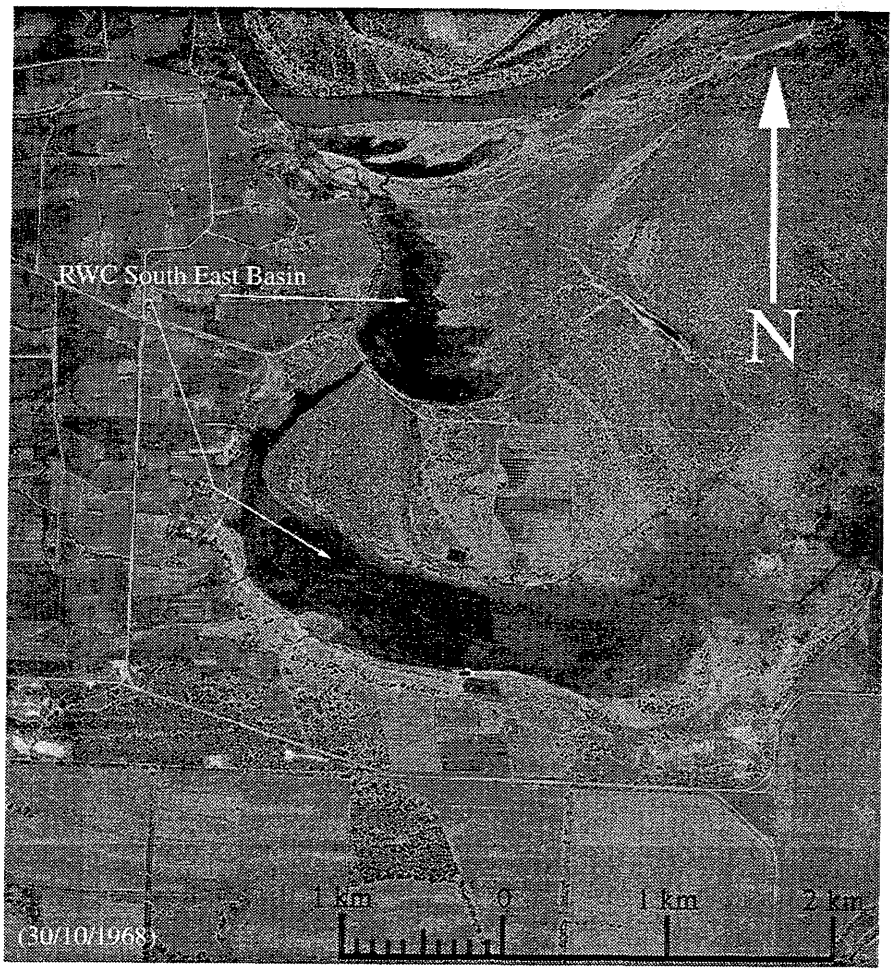
Linke, G.K., 1989- Carwarp Channel seepage effects on Murray River (Nangiloc Colignan Salinity Management Plan)., Rural Water Corporation Investigation Branch, Unpublished report 89/34

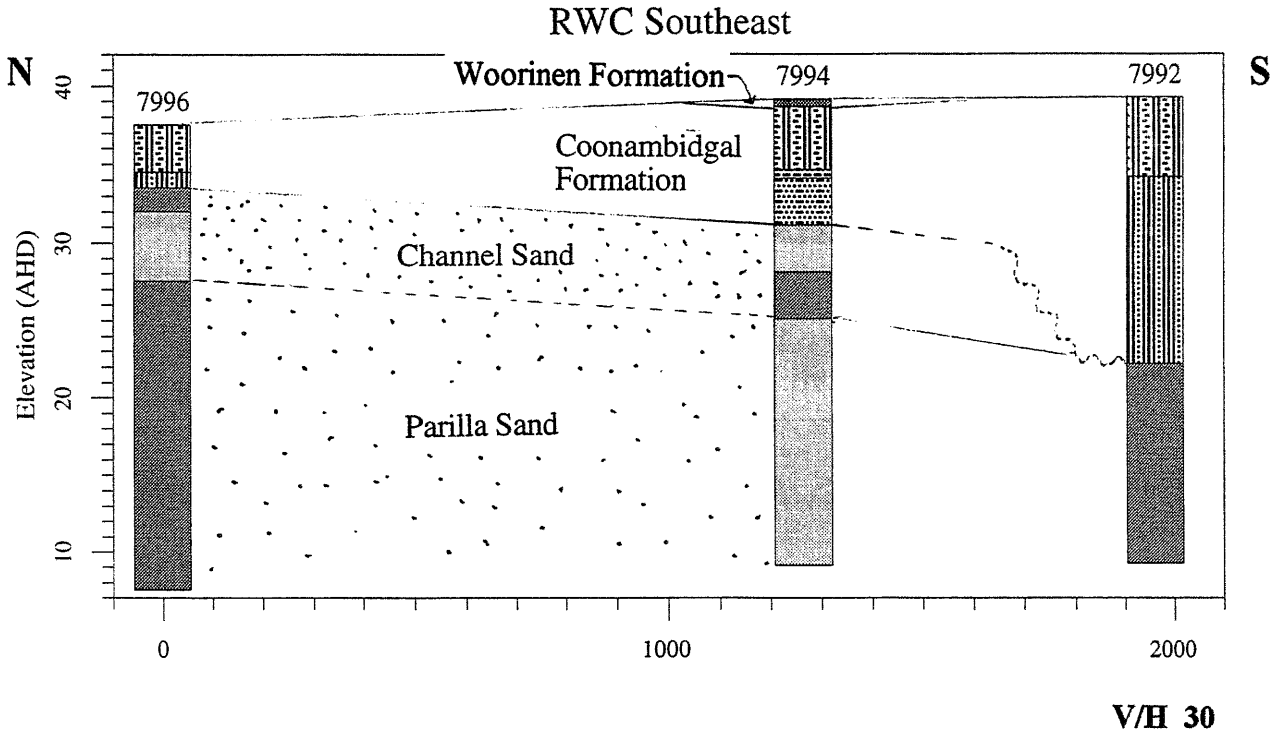
Linke, G.K., Gato, S., and Northey, P., 1991a- Evaluation of drainage disposal options for Red Cliffs: background report for Sunraysia Salinity Management Plan., Rural Water Commission of Victoria Report no. 1991/24

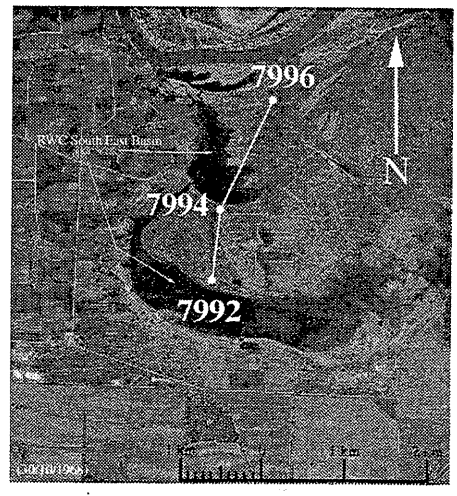
Rural Water Commission, 1993- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


RWC South East Basin
N
1 km
0
1 km
2 km
(30/10/1968)


RWC Southeast
N
S
Woorinen Formation
7996
7994
7992
Coonambidgal Formation
Channel Sand
Parilla Sand
Elevation (AHD)
40
30
20
10
0
1000
2000
V/H 30


7996
7994
7992
N

<Site Name> Sandilong Park
<**Synonyms**> Sandilong Park Recreation Reserve

Spatial

<**Location description**> Located on Murray floodplain, east of Mildura, just south of Mildura golf course

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 611500

<**Coordinates northing (AMG)**> 6215500

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**>

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> ~36 m AHD

<**Groundwater level (m AHD)**> ~35.5 m AHD in Channel Sand (Lawrence, 1991)

<**Groundwater seepage/discharge**> Evaporation discharge

<**Average annual evaporation**> 1980 mm/yr Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**> 20,000 to 35,000 mg/L TDS

<**Range of salinity in basin (EC)**>

<**Sources of water to be disposed**> Groundwater evaporation discharge

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**> Because of discharge, the basin could erode and eventually form a deflation basin. There is severe degradation and salt scalding in the southern part of the reserve.

<Site Name> Sandilong Park
<**Synonyms**> Sandilong Park Recreation Reserve

Engineering/Admin

<**Public or private operation**> Private

<**Agency responsible**> Golf Club

<**Project name**> None

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is a dry lake (deflation basin) that formerly received discharge. It is on the Murray River floodplain and is bounded by a lunette on its eastern flank.

<**Subsurface investigations at site**> RWC bores 7390, 7391, 7392

<**Structural setting**> The basin is located northwest of the Red Cliffs Ridge, southeast of the Koorlong Trough, and northeast of the Wargan Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Coonambidgal Formation (3-5), and underlain by the Channel Sand (Monoman Formation) (7-10 m), the Parilla Sand (20 m), the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Coonambidgal Formation

<**Host lithofacies**> Clay and silt

<**Aquitard**> Coonambidgal Formation and Upper Parilla Sand

<**Aquitard lithofacies**> Coonambidgal Formation: Clay and silt; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Channel Sand and Parilla Sand

<**Aquifer lithofacies**> Channel Sand and Parilla Sand: Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 500 metres

<Site Name> Sandilong Park
<Synonyms> Sandilong Park Recreation Reserve

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Northeast towards the Murray River (RWC, 1991).

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Coonambidgal Formation: 3-5 metres; Upper Parilla Sand: 5-7 metres

<kv and kh of aquifer> Channel Sand: Kh = 10-50 m/day, Parilla Sand: 1 m/day (Linke, 1990b)

<EC of aquifer> Channel Sand: 40,000 EC. Parilla Sand: 30,000 EC (Thorne, Hoxley, and Chaplin, 1990)

<Porosity of aquifer>

<Thickness of aquifer> Channel Sand: 7-10 metres; Parilla Sand: 20 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin has received discharge in the past and has partially deflated through the Coonambidgal Formation. Depending on the river level (which controls water levels in the Channel Sand) the basin will receive discharge (high river) or leak into the Channel Sand (low river). The Channel Sand is separated from the Parilla Sand by the Upper Parilla Sand aquitard which may or may not have been eroded due to river entrenchment. Therefore water that leaks from the basin needs to pass through 3-5 metres (or less) of Coonambidgal Formation clays before is enters the Channel Sand and then into the river and/or the Parilla Sand. However, if the basin is kept below river level leakage will be minimal.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> Sandilong Park
<Synonyms> Sandilong Park Recreation Reserve

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Lawrence, C.R., 1991- Preliminary hydrogeological analysis of sensitive areas of the Murray River Trench - Sunraysia., Office of Water Resources, Victoria, Unpublished report

Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
Sandilong Park
1 km
0
1 km
2 km
(30/10/1968)

<Site Name> Smith
<Synonyms>

Spatial

<Location description>

<Located in Murray Trench> Yes

<Location 1:250 000>

<Location 1:100 000>

<Zone>

<Coordinates easting (AMG)>

<Coordinates northing (AMG)>

<State> Victoria

General

<Year begun operation>

<Active/inactive>

<Full surface area (ha)> 0.16 ha

<Volume capacity (ML)>

<Full surface level (m AHD)>

<Groundwater level (m AHD)>

<Groundwater seepage/discharge>

<Average annual evaporation>

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)>

<Sources of water to be disposed> Irrigation discharge

<Terminal/throughflow basin>

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

R9500410

<Site Name> Smith
<Synonyms>

Engineering/Admin

<Public or private operation> Public

<Agency responsible>

<Project name> Smith

<Natural, modified natural or constructed>

<Modification type and degree>

Geological

<Site description and Geomorphology>

<Subsurface investigations at site>

<Structural setting>

<Stratigraphic setting>

<Host formation>

<Host lithofacies>

<Aquitard>

<Aquitard lithofacies>

<Aquifer>

<Aquifer lithofacies>

<Comments>

Summary of Hydrodynamics

<Distance to Murray or tributary>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer>

<kv of artificial floor>

<Site Name> Smith
<Synonyms>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard>

<kv and kh of aquifer>

<EC of aquifer> > 20,000 mg/L TDS (RWC, 1993a)

<Porosity of aquifer>

<Thickness of aquifer>

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer>

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

<Site Name> Smiths
<Synonyms>

Spatial

<**Location description**> 9 kilometres west of Pyramid Hill, Victoria and 7 kilometres SW of Mincha, Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Bendigo

<**Location 1:100 000**> Mitiamo 7725

<**Zone**> 55

<**Coordinates easting (AMG)**> 231000

<**Coordinates northing (AMG)**> 6006500

<**State**> Victoria

General

<**Year begun operation**> 1992

<**Active/inactive**> Inactive

<**Full surface area (ha)**> 3.3 ha

<**Volume capacity (ML)**> 33 ML

<**Full surface level (m AHD)**> 86.70 m AHD

<**Groundwater level (m AHD)**> 85.70-86.40 m AHD

<**Groundwater seepage/discharge**> 2-4 mm/day seepage

<**Average annual evaporation**>

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**> 40,000 EC

<**Range of salinity in basin (EC)**> 40,000-70,000 EC

<**Sources of water to be disposed**> Tile drainage system

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> Smiths
<Synonyms>

Engineering/Admin

<**Public or private operation**> Private

<**Agency responsible**> Department of Agriculture

<**Project name**> Tragowel Plains Salinity Management Plan

<**Natural, modified natural or constructed**> Constructed

<**Modification type and degree**>

Geological

<**Site description and Geomorphology**> The basin is located on the low lying Riverine Plain surrounded by creeks and channels.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located east of the Cadell Fault on the Riverine Floodplain (Lawrence and Macumber, 1974).

<**Stratigraphic setting**> The basin is floored by the Shepparton Formation and underlain by the Calivil Formation and the Renmark Group (A. Harrison pers. comm.).

<**Host formation**> Shepparton Formation

<**Host lithofacies**> Clays and silts

<**Aquitard**> Shepparton Formation

<**Aquitard lithofacies**> Clays and silty clays

<**Aquifer**> Shepparton Formation and Calivil Formation

<**Aquifer lithofacies**> Shepparton Formation: Two aquifers one at 16 metres which is a fine sandy layer, medium-coarse sand with silty sand in NE-SW trending lens, the other at 6 metres; Calivil Formation: gravel and sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 31 kilometres to Gunbower Creek

<**Head between basin and river/tributary**>

<Site Name> Smiths
<Synonyms>

<Direction of groundwater flow in regional aquifer> North-northwest (Williams and Woolley, 1992)

<kv of artificial floor>

<kv and kh of host> Shepparton Formation: variable Kv = 6×10^{-5} to 1.2×10^{-1} m/day; Kh = 0.2 to 0.7 m/day (Ife, 1984)

<kv and kh of aquitard> Shepparton Formation: variable Kv = 6×10^{-5} to 1.2×10^{-1} m/day; Kh = 0.2 to 0.7 m/day (Ife, 1984)

<Thickness of aquitard>

<kv and kh of aquifer>

<EC of aquifer> > 50,000 mg/L TDS (RWC, 1993a)

<Porosity of aquifer>

<Thickness of aquifer> Shepparton Formation: Variable depending on the presence or absence of sand bodies

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Leakage from the basin ranges from 24-48 ML/year, and although the input to the basin is unknown, the small size of the basin (3.3 ha), suggests that it is a significant percentage of inflow. The small range in salinities (40,000-70,000 EC) of the basin also suggests that there is a rapid seepage from the basin because there is not enough time to concentrate the brine to higher salinities. A high rate of seepage into the Shepparton Formation usually indicates that the basin is located on or near a prior stream sand deposit, because in general the Shepparton Formation has a low permeability. Because of the isolation of the prior streams channels within the Shepparton Formation there is probably little seepage into the rest of the Shepparton Formation or downwards into the Calivil Formation. Problems however, may be encountered due to a localised raising of the watertable and by discharge of saline water into creeks or channels from the prior streams.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> Smiths
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

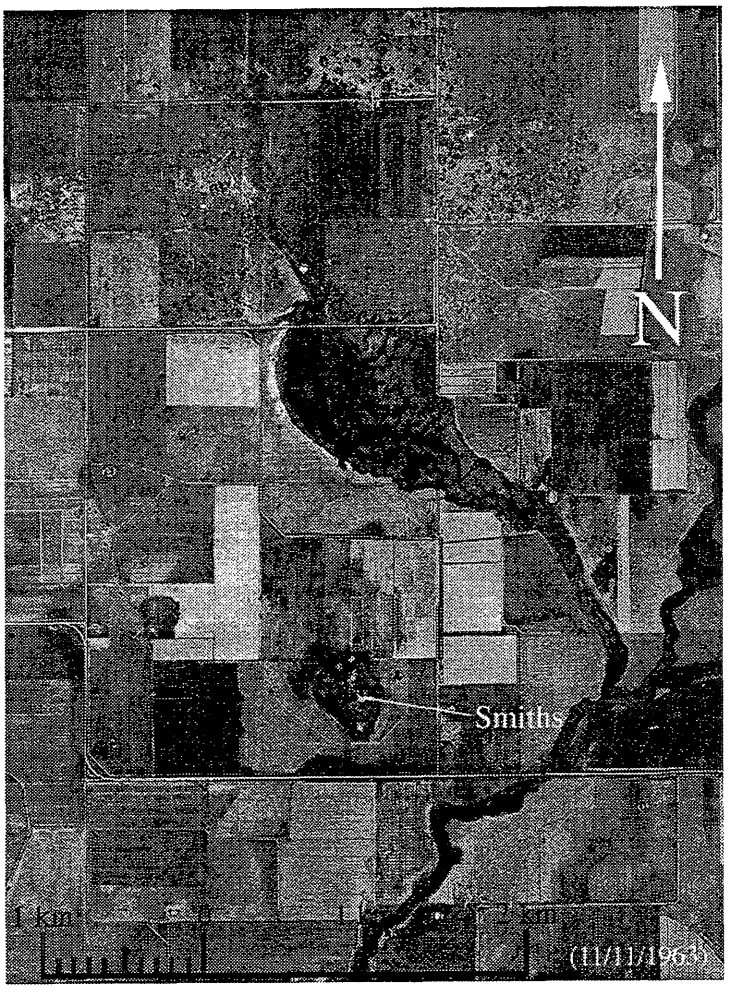
References Cited

Ife, D., 1984- Salinisation and groundwater studies in the Shepparton Region., Unpublished M.App.Sc. thesis, University of NSW

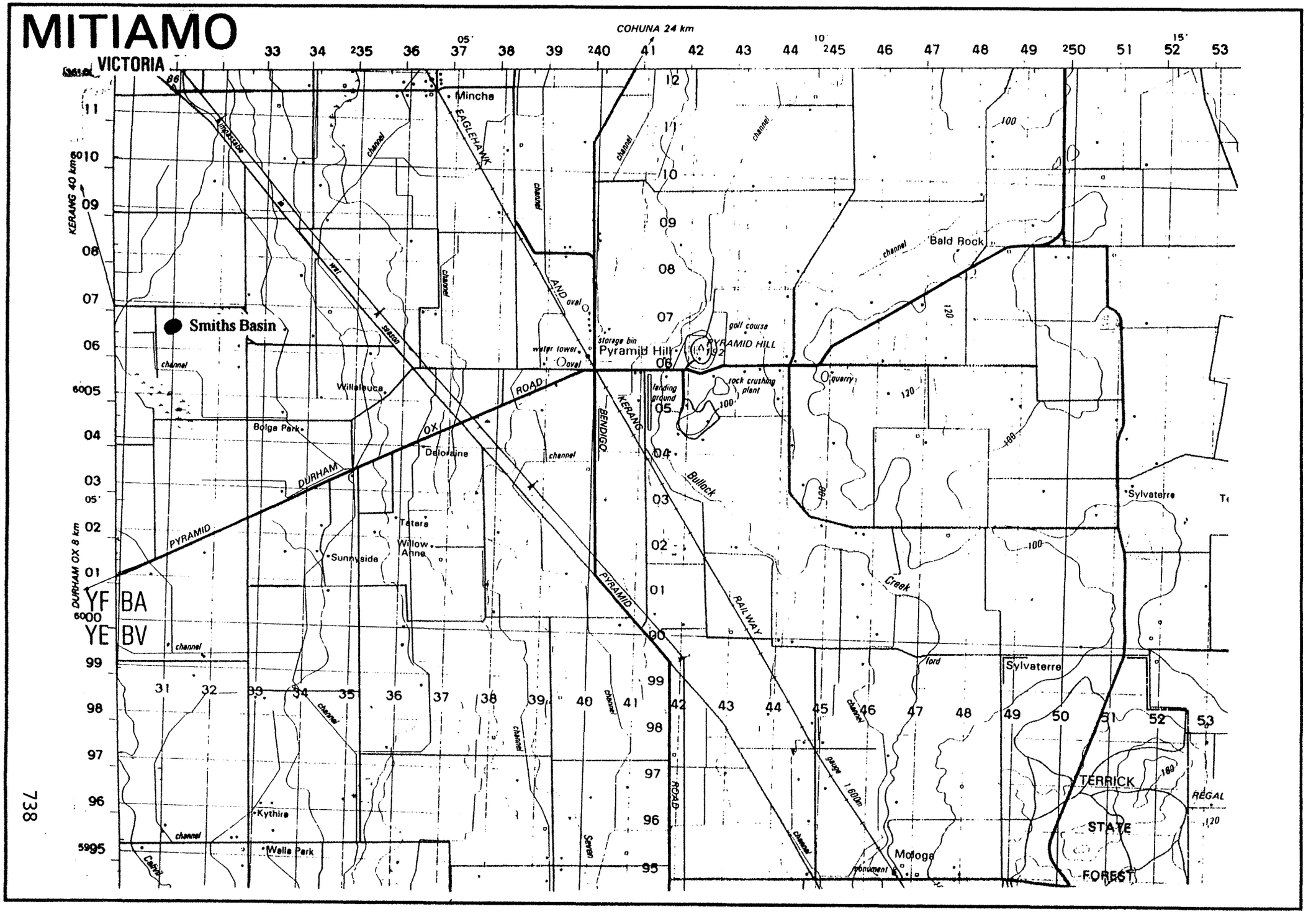
Lawrence, C.R., and Macumber, P.G., 1974- Geology of part of Balranald and Deniliquin (1:250,000 scale)., Geological Survey of Victoria

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Williams, R.M. and Woolley, D. Department of Water Resources, 1992- Deniliquin Hydrogeological Map (1:250 000 scale), Australian Geological Survey Organisation, Canberra, Australia


N
Smiths
1 km
1 km
2 km
(11/11/1963)

MITIAMO


VICTORIA
COHUNA 24 km
KERANG 40 km
DURHAM OX 8 km
Smiths Basin
Mincha
EAGLEHAWK
AND
BENDIGO
KERANG
RAILWAY
PYRAMID
DURHAM
OX
ROAD
Pyramid Hill
PYRAMID HILL
golf course
rock crushing plant
landing ground
storage bin
water tower
oval
Bald Rock
quarry
Willaleuca
Bolga Park
Deloraine
Tatara
Willow Anne
Sunnyside
Kythira
Walla Park
Sylvaterre
Mologa
TERRICK
STATE
FOREST
REGAL
Bullock
Creek
ford
channel
gauge 1,600m
YF BA
YE BV

<Site Name> Sunnycliffs/Minter
<Synonyms>

Spatial

<**Location description**> 2 kilometres south of Karadoc Swamp and 10 kilometres NE of Carwarp, Victoria

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 619100

<**Coordinates northing (AMG)**> 6191000

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 1.0 ha

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**>

<**Groundwater level (m AHD)**> Channel Sand: 38.1 m AHD, Parilla Sand: 37 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<**Groundwater seepage/discharge**> Both

<**Average annual evaporation**> 1980 mm/yr Class A pan Red Cliffs

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**> Dry

<**Sources of water to be disposed**> Tile Drains

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> Sunnycliffs/Minter
<Synonyms>

Engineering/Admin

<**Public or private operation**> Private

<**Agency responsible**> Landholders

<**Project name**> Sunnycliffs/Minter

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is located within the Murray Trench and the Rufus Terrace. It is built in a depression within the longitudinal Woorinen dunes and is surrounded by cleared mallee and irrigation land.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is just southeast of the Neckarboo Ridge and northeast of the Wargan Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (5 m) and underlain by the Rufus Formation (3 m), the Channel Sand (6-10 m), the Blanchetown Clay (13 m), the Parilla Sand (80 m), the Bookpurnong Beds, the Murray group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Rufus Formation and Blanchetown Clay

<**Aquitard lithofacies**> Rufus Formation: Silt and silty clay; Blanchetown Clay: Clay

<**Aquifer**> Channel Sand and Parilla Sand

<**Aquifer lithofacies**> Channel Sand and Parilla Sand: Coarse and medium sand

<**Comments**>

<Site Name> Sunnycliffs/Minter
<Synonyms>

Summary of Hydrodynamics

<Distance to Murray or tributary> 4.5 kilometres

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> North to Karadoc Swamp (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Rufus Formation: 3 metres; Blanchetown Clay: 13 metres

<kv and kh of aquifer> Channel Sand: Kh = 10-40 m/day, Parilla Sand Kh = 1 m/day (Linke, 1990b)

<EC of aquifer> 35,000-50,000 mg/L TDS (RWC, 1993); Channel Sand: 50,000 (Thorne, Hoxley, and Chaplin, 1990); Parilla Sand 40,000-50,000 EC (Linke, 1993).

<Porosity of aquifer> Channel Sand: 20% (Linke, 1990b)

<Thickness of aquifer> Channel Sand: 7-10 metres; Parilla Sand: 80 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin is located at about the same height as the potentiometric surface of the Channel Sand, so when it is full it leaks and when empty it receives discharge (interpreted). The amount of disposal is unknown, but because of the size of the basin (1 ha), it probably exceeds the evaporation capacity (19.8 ML/yr) which would tend to encourage leakage from the basin by increasing the head between the basin and the Channel Sand. Separating the basin from the Channel Sand is the Rufus Formation, which is thought to leak at a rate of 0.4 ML/ha/yr (Linke, 1993). Because of the aquitard the water will spread laterally within the Woorinen Formation forming a large perched aquifer. The perched watertable will grow until it reaches an equilibrium between inflow and downward leakage into the Channel Sand. The water that does enter the aquifer will flow north to Karadoc Swamp, which is a regional discharge site.

<Site Name> Sunnycliffs/Minter
<Synonyms>

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

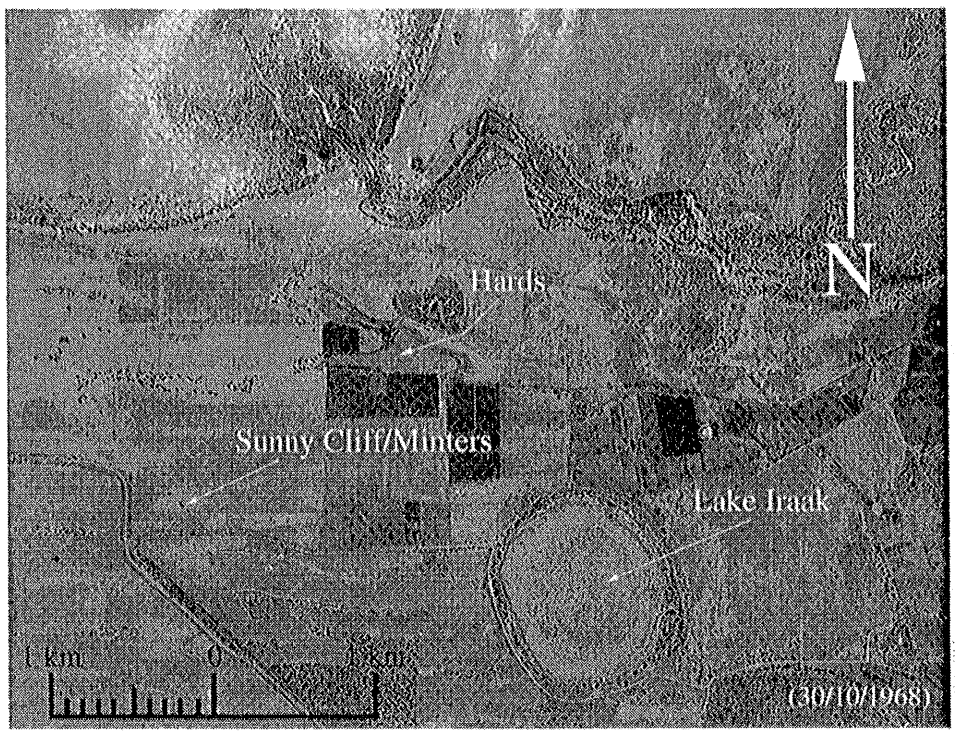
Barling. R., and Linke, G., 1993- Nangiloc Colignan Salinity Management Plan Technical note on Lake Iraak and Doerings Basin., Rural Water Corporation, Unpublished technical note

Linke, G., 1993- Nangiloc Colignan SMP - Drainage disposal to Karadoc Swamp - CMS Comps., Rural Water Corporation, Unpublished working file No. 93/01895

Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
Hardś
Sunny Cliff/Minters
Lake Iraak
1 km
0
1 km
(30/10/1968)

<Site Name> Sutherlands
<Synonyms>

Spatial

<Location description> 8 kilometres WSW of Cohuna, Victoria and 22 kilometres south of Koondrook, Victoria

<Located in Murray Trench> No

<Location 1:250 000> Deniliquin

<Location 1:100 000> Cohuna 7726

<Zone> 55

<Coordinates easting (AMG)> 240200

<Coordinates northing (AMG)> 6030000

<State> Victoria

General

<Year begun operation> 1973

<Active/inactive> Inactive

<Full surface area (ha)> 3 ha

<Volume capacity (ML)> 30 ML

<Full surface level (m AHD)> > 80 m AHD (estimated)

<Groundwater level (m AHD)> ~79 m AHD (Williams and Woolley, 1992)

<Groundwater seepage/discharge> 3-6 mm/day seepage

<Average annual evaporation> Inflow/evaporation > 1.5

<Volume disposed annually (ML/yr)> 73 ML/yr

<Salinity of water disposed (EC)> 50,000 EC

<Range of salinity in basin (EC)> 59800-71,400 EC

<Sources of water to be disposed> Groundwater pump

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts> Basin disused since 1985

<Site Name> Sutherlands
<Synonyms>

Engineering/Admin

<**Public or private operation**> Private

<**Agency responsible**>

<**Project name**> Sutherlands

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Banks have been built

Geological

<**Site description and Geomorphology**> The basin is located on the gently undulating Shepparton Formation floodplain northeast of Hird Swamp and ESE of Johnson Swamp.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located east of the Cadell fault on a leveed stream terrace (Lawrence and Macumber, 1974).

<**Stratigraphic setting**> The basin is floored by the Shepparton Formation (40 m), and underlain by the Calivil Formation (40 m) (Geology interpreted from Williams and Woolley, 1992).

<**Host formation**> Shepparton Formation

<**Host lithofacies**> Clays and silts, probably a prior stream channel as well

<**Aquitard**> Shepparton Formation

<**Aquitard lithofacies**> Clays and silts

<**Aquifer**> Shepparton Formation and Calivil Formation

<**Aquifer lithofacies**> Shepparton Formation: Prior stream channel; Calivil Formation: gravel and coarse sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 12 kilometres to Gunbower Creek

<**Head between basin and river/tributary**>

<Site Name> Sutherlands
<Synonyms>

<Direction of groundwater flow in regional aquifer> NNW ultimately to Lake Tyrrell (Williams and Woolley, 1992; and O'Rourke, 1992)

<kv of artificial floor>

<kv and kh of host> Shepparton Formation: Kv = 0.06 to 0.28 m/day average of 0.18 m/day at a depth of 1.8 to 2.5 metres (McConachy, 1991)

<kv and kh of aquitard> Shepparton Formation: Kv = 0.06 to 0.28 m/day average of 0.18 m/day at a depth of 1.8 to 2.5 metres (McConachy, 1991)

<Thickness of aquitard> 40 metres

<kv and kh of aquifer>

<EC of aquifer> 35,000-50,000 mg/L TDS (RWC, 1993a)

<Porosity of aquifer>

<Thickness of aquifer> Shepparton Formation: variable depending of presence or absence of shoestring sand body; Calivil Formation: 40 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin is estimated to leak at a rate of 3-6 mm/day, or approximately 45-90% of inflow. This is because it is probably located on a prior stream channel within the Shepparton Formation which although it has little lateral continuity, the connectivity along the sand body is very high. The shoestring sand bodies are isolated from each other by low permeability clays and silts that act to retard vertical water movement, so although the leakage would raise the local watertable it should not affect the Calivil Formation.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Site Name> Sutherlands
<Synonyms>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Lawrence, C.R., and Macumber, P.G., 1974- Swan Hill Geological Map (1:250,000 scale)., Geological Survey of Victoria

McConachy, F., 1991- Design of an evaporation basin and tile drainage demonstration site on the Tragowel Plains., Rural Water Corporation, Unpublished report

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Williams, R.M. and Woolley, D. Department of Water Resources, 1992- Deniliquin Hydrogeological Map (1:250 000 scale), Australian Geological Survey Organisation, Canberra, Australia


N
Sutherlands
1 Km
2 Km
(30/10/1968)

<Site Name> Golf Club
<Synonyms> Tresco

Spatial

<**Location description**> 6 kilometres WNW of Tresco, Victoria and 3 kilometres SW of Lake Boga, Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Swan Hill

<**Location 1:100 000**> Swan Hill 7627

<**Zone**> 54

<**Coordinates easting (AMG)**> 737200

<**Coordinates northing (AMG)**> 6070300

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 100 ha

<**Volume capacity (ML)**> 1000 ML

<**Full surface level (m AHD)**> 67.82 m AHD

<**Groundwater level (m AHD)**> 67.2 m AHD (Bore 6291 RWC, 1993b)

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> Inflow/evaporation = 0.3

<**Volume disposed annually (ML/yr)**> 300 ML/yr

<**Salinity of water disposed (EC)**> 9700 EC

<**Range of salinity in basin (EC)**> 30,000-50,000 EC

<**Sources of water to be disposed**> Tile drains in Tresco Irrigation Area

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> Golf Club
<**Synonyms**> Tresco

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Tresco Irrigation District

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is located within a deflation basin that has partially eroded through the Shepparton Formation and has formed a lunette on the basin's eastern margin. It consists of two sub-basins joined along their eastern margins and is surrounded by a golf course and farmland.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located on the Canine Ridge southwest of the Kerang Lakes Trough (Pratt, 1988).

<**Stratigraphic setting**> The basin is floored by the Shepparton Formation (3-5 m), and underlain by the Parilla Sand (37 m), and the Renmark Group (Geology interpreted from Pratt, 1988).

<**Host formation**> Shepparton Formation

<**Host lithofacies**> Clays and silts

<**Aquitard**> Shepparton Formation

<**Aquitard lithofacies**> Clays and silts

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 8 kilometres

<Site Name> Golf Club
<Synonyms> Tresco

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> West away from the Murray River (O'Rourke, 1992)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Shepparton Formation: 3-5 metres

<kv and kh of aquifer>

<EC of aquifer> 35,000-50,000 mg/L TDS (RWC, 1993a)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 37 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin lies at the contact between the Shepparton Formation and the Parilla Sand (Lawrence and Macumber, 1974). The Parilla Sand is high in the area due to uplift of the Leaghur Fault, which resulted in either lack of deposition or erosion of the Shepparton Formation. However, the Shepparton Formation has been preserved in the Avoca River Valley (Avoca Graben) (Pratt, 1988). During periods when the watertable was higher the Parilla Sand was under artesian pressure and discharged along its contact with the Shepparton Formation forming the Tresco Lake System. Presently, water levels are lower than the surface allowing seepage into the Parilla Sand to occur. The amount of seepage is unknown, but it could be potentially very high where the basin lies on the Parilla Sand. This may be tempered by the high rate of evaporation in the basin (Inflow is 0.2 evaporation) which would concentrate the water (increasing salinity) and lessening the impact (smaller mound equals longer time to reach the river). Water that does enter the Parilla Sand will flow to the west into the mallee.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> Golf Club
<Synonyms> Tresco

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

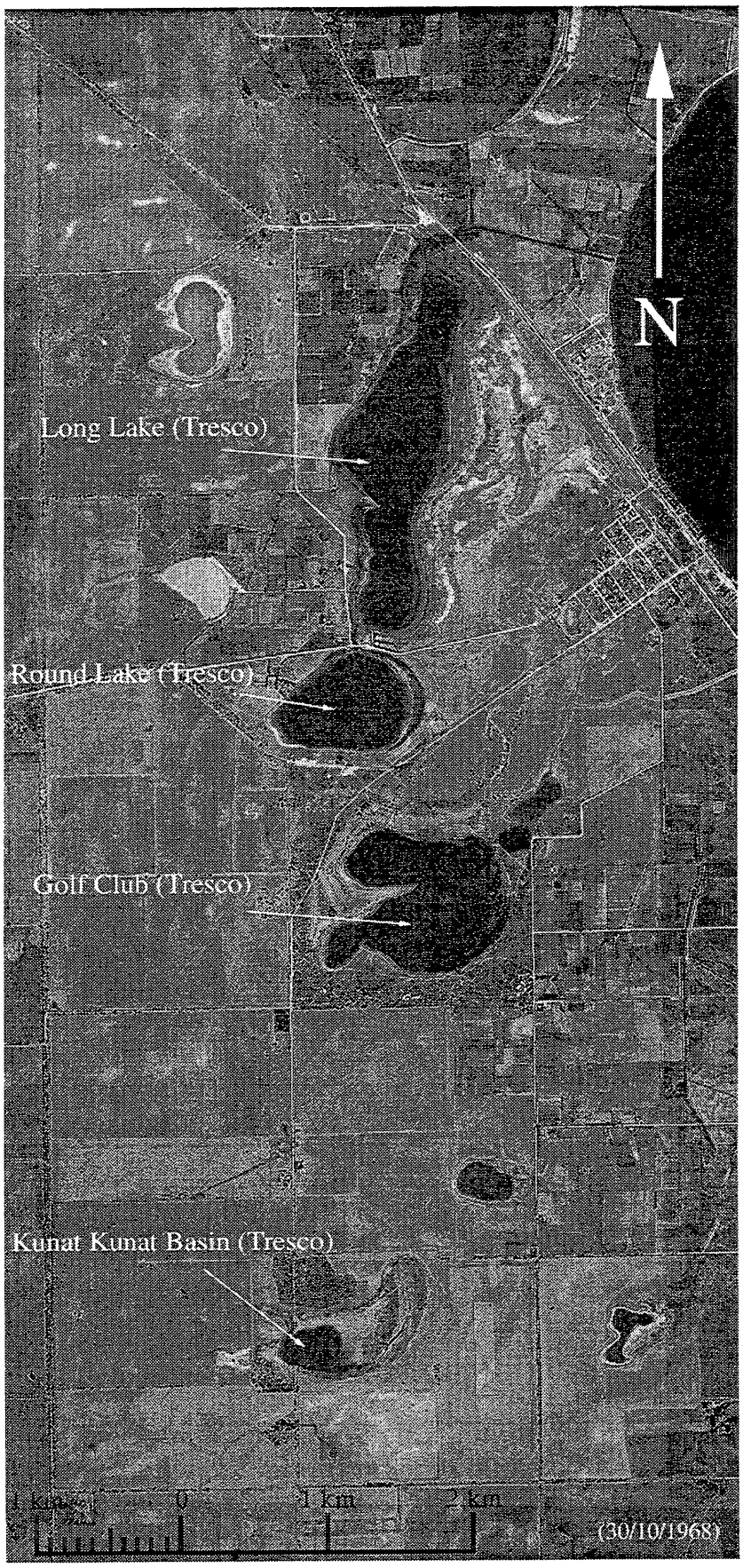
Lawrence, C.R., and Macumber, P.G., 1974- Swan Hill Geological Map (1:250,000 scale)., Geological Survey of Victoria

O'Rourke, M.E., et. al, Victorian Rural Water Commission, 1992- Swan Hill Hydrogeological Map (1:250,000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra Australia

Pratt, M.C., 1988- Hydrogeological assessment of the Loddon and Avoca Plains., Department of Water Resources, Victoria, Unpublished report

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1993b- Hydrographs and E.C. plots for bores in the proximity of evaporation disposal basins, Draft report, Unpublished, 386 pp.


N
Long Lake (Tresco)
Round Lake (Tresco)
Golf Club (Tresco)
Kunat Kunat Basin (Tresco)
1 km
0
1 km
2 km
(30/10/1968)

<Site Name> Kunat Kunat
<Synonyms> Tresco

Spatial

<Location description> 4 kilometres SSW of Lake Boga and 4.5 kilometres west of Tresco, Victoria

<Located in Murray Trench> No

<Location 1:250 000> Swan Hill

<Location 1:100 000> Swan Hill 7627

<Zone> 54

<Coordinates easting (AMG)> 737400

<Coordinates northing (AMG)> 6068500

<State> Victoria

General

<Year begun operation> 1960

<Active/inactive> Active

<Full surface area (ha)> 150 ha?

<Volume capacity (ML)>

<Full surface level (m AHD)> <70 m AHD (estimate)

<Groundwater level (m AHD)> 67.0 m AHD (Bore 6901, RWC, 1993b)

<Groundwater seepage/discharge> Seepage

<Average annual evaporation> Inflow/evaporation < 0.2

<Volume disposed annually (ML/yr)> 100 ML/yr

<Salinity of water disposed (EC)> 30,000 EC

<Range of salinity in basin (EC)>

<Sources of water to be disposed> Tile drains in Tresco Irrigation Area

<Terminal/throughflow basin> Terminal

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> Kunat Kunat
<Synonyms> Tresco

Engineering/Admin

<**Public or private operation**> Private

<**Agency responsible**> Rural Water Corporation

<**Project name**> Tresco Irrigation Area

<**Natural, modified natural or constructed**> Constructed

<**Modification type and degree**>

Geological

<**Site description and Geomorphology**> Kunat Kunat is a sub-basin within a larger deflation basin that has eroded through the Shepparton Formation. It is bounded by a lunette on its eastern margin and shows evidence of salt accumulation around the edges of the lake and is surrounded by farmland.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located on the Canine Ridge southwest of the Kerang Lakes Trough (Pratt, 1988).

<**Stratigraphic setting**> The basin is floored by the Shepparton Formation (2-3 m), and underlain by the Parilla Sand (35-40 m), and the Renmark Group (Geology interpreted from Pratt, 1988)

<**Host formation**> Shepparton Formation and Parilla Sand

<**Host lithofacies**> Shepparton Formation: Clays and silts with occasional sand lenses; Parilla Sand: Fine to medium sand

<**Aquitard**> Shepparton Formation

<**Aquitard lithofacies**> Clays and silts

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 9.5 kilometres

<**Head between basin and river/tributary**>

<Site Name> Kunat Kunat
<Synonyms> Tresco

<Direction of groundwater flow in regional aquifer> West away from the Murray River and into the mallee country (O'Rourke et. al, 1992)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Shepparton Formation: 0-10 metres

<kv and kh of aquifer>

<EC of aquifer> Parilla Sand: 35,000-50,000 mg/L TDS (RWC, 1993)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 40 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin lies at the contact between the Shepparton Formation and the Parilla Sand (Lawrence and Macumber, 1974). The Parilla Sand is high in the area due to uplift of the Leaghur Fault, which resulted in either lack of deposition or erosion of the Shepparton Formation. However, the Shepparton Formation has been preserved in the Avoca River Valley (Avoca Graben) (Pratt, 1988).

During periods when the watertable was higher the Parilla Sand was under artesian pressure and discharged along its contact with the Shepparton Formation forming the Tresco Lake System. Presently, water levels are lower than the surface allowing seepage into the Parilla Sand to occur. The amount of seepage is unknown, but it could be potentially very high where the basin lies on the Parilla Sand. This may be tempered by the high rate of evaporation in the basin (Inflow is 0.2 evaporation), which would concentrate the water (increasing salinity) and lessening impact (smaller mound equals longer time to reach the river). Water that does enter the Parilla Sand will flow to the west into the mallee.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> Kunat Kunat
<Synonyms> Tresco

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

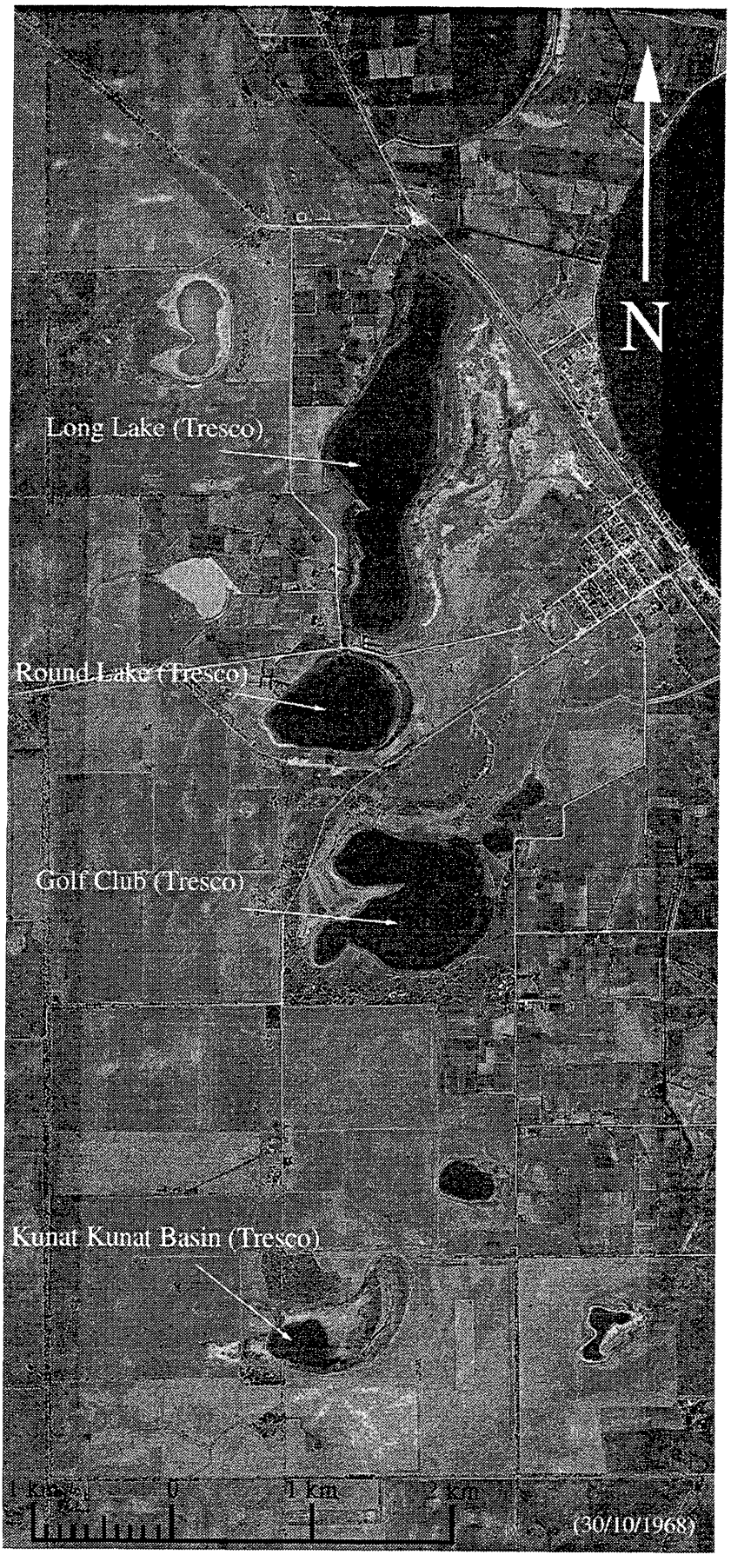
Lawrence, C.R., and Macumber, P.G., 1974- Swan Hill Geological Map (1:250,000 scale)., Geological Survey of Victoria

O'Rourke, M.E., et. al, Victorian Rural Water Commission, 1992- Swan Hill Hydrogeological Map (1:250,000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra Australia

Pratt, M.C., 1988- Hydrogeological assessment of the Loddon and Avoca Plains., Department of Water Resources, Victoria, Unpublished report

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1993b- Hydrographs and E.C. plots for bores in the proximity of evaporation disposal basins, Draft report, Unpublished, 386 pp.


N
Long Lake (Tresco)
Round Lake (Tresco)
Golf Club (Tresco)
Kunat Kunat Basin (Tresco)
1 km
0
1 km
2 km
(30/10/1968)

<Site Name> Long Lake
<Synonyms> Tresco

Spatial

<**Location description**> 12 kilometres SSE of Swan Hill, Victoria and 1.5 kilometres WNW of Lake Boga, Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Swan Hill

<**Location 1:100 000**> Swan Hill 7627

<**Zone**> 54

<**Coordinates easting (AMG)**> 737000

<**Coordinates northing (AMG)**> 6073000

<**State**> Victoria

General

<**Year begun operation**> 1917

<**Active/inactive**> Active

<**Full surface area (ha)**> 115 ha

<**Volume capacity (ML)**> 470 ML

<**Full surface level (m AHD)**> 67.82 M AHD

<**Groundwater level (m AHD)**> ~67.2 m AHD (estimate based on Bores 6291 and 6282, RWC, 1993b)

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> Inflow/evaporation = 0.3

<**Volume disposed annually (ML/yr)**> 300 ML/yr

<**Salinity of water disposed (EC)**> 30,000 EC

<**Range of salinity in basin (EC)**> 29,000-202,000 EC

<**Sources of water to be disposed**> Tile drains in the Tresco Irrigation Area

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> Long Lake
<Synonyms> Tresco

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Tresco Irrigation Area

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> Long Lake is a narrow north-south trending lake located in a deflation basin that has partially eroded through the Shepparton Formation and has formed a lunette on the basin's eastern margin. It is separated from Round Lake to the south (which is also part of the deflation basin) by a narrow neck of land, and is surrounded by agricultural land.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located on the Canine Ridge southwest of the Kerang Lakes Trough (Pratt, 1988).

<**Stratigraphic setting**> The basin is floored by the Shepparton Formation (3-5 m), and underlain by the Parilla Sand (40 m), and the Renmark Group (Geology interpreted from Pratt, 1988).

<**Host formation**> Shepparton Formation

<**Host lithofacies**> Clays and silts

<**Aquitard**> Shepparton Formation

<**Aquitard lithofacies**> Clays and silts

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 4 kilometres

<Site Name> Long Lake
<Synonyms> Tresco

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> West away from the Murray River (O'Rourke, 1992)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Shepparton Formation: 3-5 metres

<kv and kh of aquifer>

<EC of aquifer> 35,000-50,000 mg/L TDS (RWC, 1993a)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 40 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin lies at the contact between the Shepparton Formation and the Parilla Sand (Lawrence and Macumber, 1974). The Parilla Sand is high in the area due to uplift of the Leaghur Fault, which resulted in either lack of deposition or erosion of the Shepparton Formation. However, the Shepparton Formation has been preserved in the Avoca River Valley (Avoca Graben) (Pratt, 1988). During periods when the watertable was higher the Parilla Sand was under artesian pressure and discharged along its contact with the Shepparton Formation forming the Tresco Lake System. Presently, water levels are lower than the surface allowing seepage into the Parilla Sand to occur. The amount of seepage is unknown, but it could be potentially very high where the basin lies on the Parilla Sand. This may be tempered by the high rate of evaporation in the basin (Inflow is 0.3 evaporation), which would concentrate the water (increasing salinity) and lessening the impact. Water that does enter the Parilla Sand will flow to the west into the mallee.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> Long Lake
<Synonyms> Tresco

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

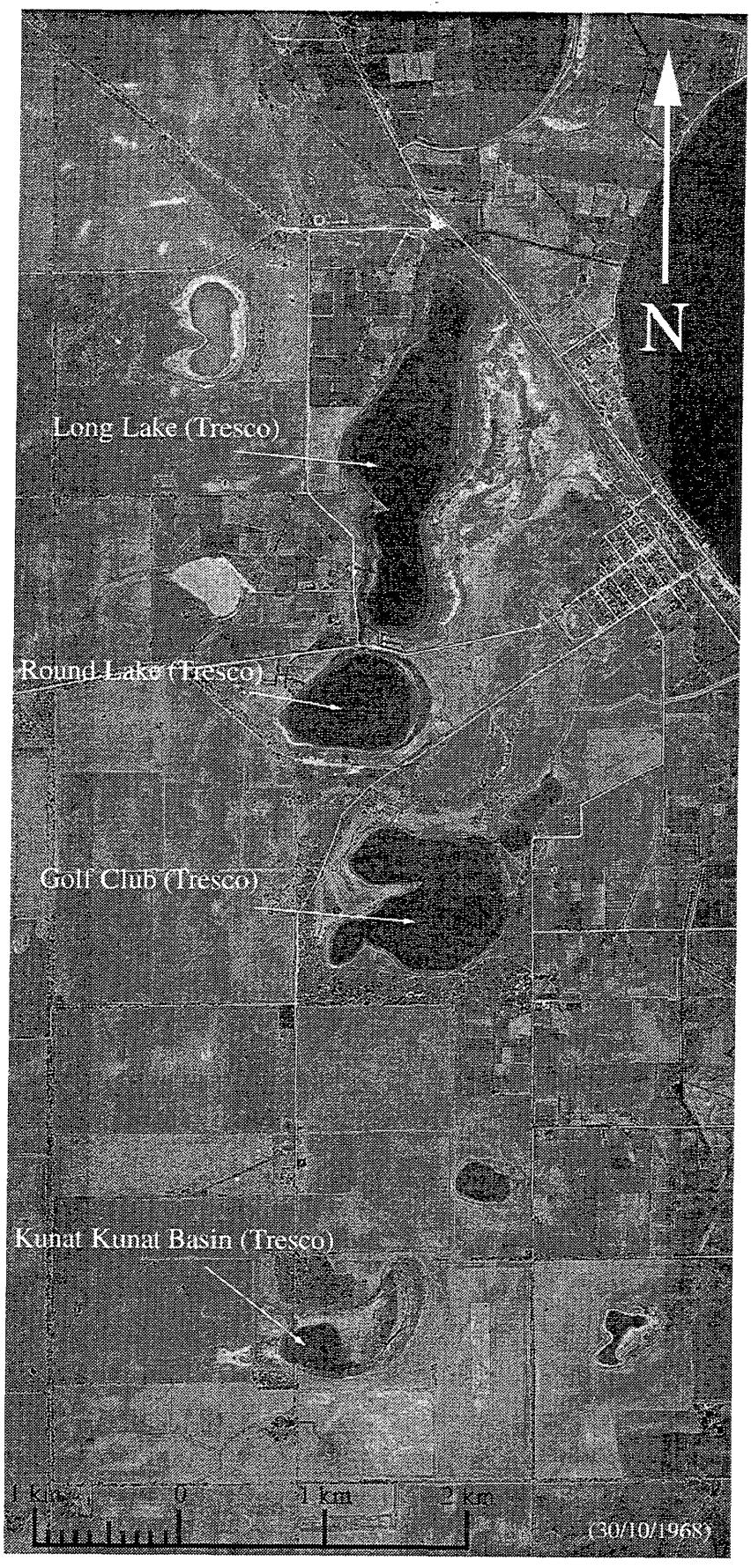
Lawrence, C.R., and Macumber, P.G., 1974- Swan Hill Geological Map (1:250,000 scale)., Geological Survey of Victoria

O'Rourke, M.E., et. al, Victorian Rural Water Commission, 1992- Swan Hill Hydrogeological Map (1:250,000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra Australia

Pratt, M.C., 1988- Hydrogeological assessment of the Loddon and Avoca Plains., Department of Water Resources, Victoria, Unpublished report

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1993b- Hydrographs and E.C. plots for bores in the proximity of evaporation disposal basins, Draft report, Unpublished, 386 pp.


N
Long Lake (Tresco)
Round Lake (Tresco)
Golf Club (Tresco)
Kunat Kunat Basin (Tresco)
1 Km
0
1 Km
2 Km
(30/10/1968)

<Site Name> Round Lake
<Synonyms> Tresco

Spatial

<Location description> 2 kilometres WSW of Lake Boga, Victoria and 15 kilometres SSE of Swan Hill, Victoria

<Located in Murray Trench> No

<Location 1:250 000> Swan Hill

<Location 1:100 000> Swan Hill 7627

<Zone> 54

<Coordinates easting (AMG)> 736700

<Coordinates northing (AMG)> 6071500

<State> Victoria

General

<Year begun operation> 1917

<Active/inactive> Active

<Full surface area (ha)> 50.1 ha

<Volume capacity (ML)> 1450 ML

<Full surface level (m AHD)> 67.82 m AHD

<Groundwater level (m AHD)> ~67.2 m AHD (Estimate from Bores 6855 and 6282, RWC, 1993b)

<Groundwater seepage/discharge> Seepage

<Average annual evaporation> Inflow/evaporation = 0.3

<Volume disposed annually (ML/yr)> 300 ML/yr

<Salinity of water disposed (EC)> 30,000 EC

<Range of salinity in basin (EC)> 51,900-83,300 EC

<Sources of water to be disposed> Tile drains in Tresco Irrigation Area

<Terminal/throughflow basin> Throughflow

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> Round Lake
<Synonyms> Tresco

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Tresco Irrigation Area

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> Round Lake is a circular lake located in a deflation basin that has eroded partially through the Shepparton Formation and has formed a lunette on the basin's eastern margin. It is separated from Long Lake to the north (which is also part of the deflation basin) by a narrow neck of land and is surrounded by agricultural land.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located on the Canine Ridge southwest of the Kerang Lakes Trough (Pratt, 1988).

<**Stratigraphic setting**> The basin is floored by the Shepparton Formation (3-5 m), and underlain by the Parilla Sand (40 m), and the Renmark Group (Geology interpreted from Pratt, 1988).

<**Host formation**> Shepparton Formation

<**Host lithofacies**> Clays and silts

<**Aquitard**> Shepparton Formation

<**Aquitard lithofacies**> Clays and silts

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 4 kilometres

<Site Name> Round Lake
<Synonyms> Tresco

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> West away from the Murray River (O'Rourke, 1992)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Shepparton Formation: 3-5 metres

<kv and kh of aquifer>

<EC of aquifer> 35,000-50,000 mg/L TDS (RWC, 1993a)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 40 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin lies at the contact between the Shepparton Formation and the Parilla Sand (Lawrence and Macumber, 1974). The Parilla Sand is high in the area due to uplift of the Leaghur Fault which resulted in either lack of deposition or erosion of the Shepparton Formation. However, the Shepparton Formation has been preserved in the Avoca River Valley (Avoca Graben) (Pratt, 1988). During periods when the watertable was higher the Parilla Sand was under artesian pressure and discharged along its contact with the Shepparton Formation forming the Tresco Lake System. Presently, water levels are lower than the surface, allowing seepage into the Parilla Sand to occur. The amount of seepage is unknown, but it could be potentially very high where the basin lies on the Parilla Sand. The rate of groundwater accession may be tempered by the high rate of evaporation in the basin (Inflow is 0.3 evaporation) which would concentrate the water (increasing salinity) and lessen impact (smaller mound equals longer time to reach the river). Water that does enter the Parilla Sand will flow to the west into the mallee.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> Round Lake
<Synonyms> Tresco

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

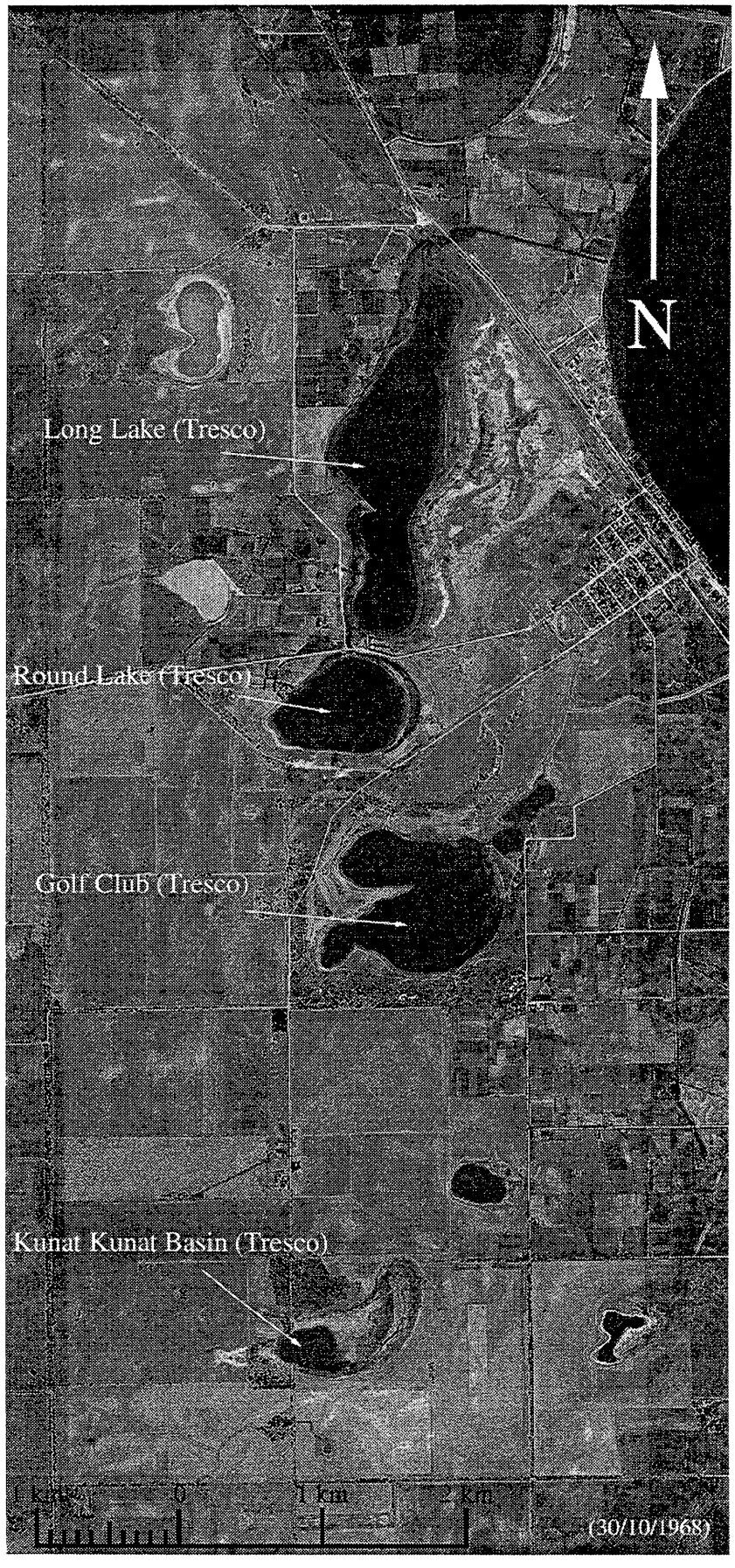
Lawrence, C.R., and Macumber, P.G., 1974- Swan Hill Geological Map (1:250,000 scale)., Geological Survey of Victoria

O'Rourke, M.E., et. al, Victorian Rural Water Commission, 1992- Swan Hill Hydrogeological Map (1:250,000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra Australia

Pratt, M.C., 1988- Hydrogeological assessment of the Loddon and Avoca Plains., Department of Water Resources, Victoria, Unpublished report

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1993b- Hydrographs and E.C. plots for bores in the proximity of evaporation disposal basins, Draft report, Unpublished, 386 pp.


N
Long Lake (Tresco)
Round Lake (Tresco)
Golf Club (Tresco)
Kunat Kunat Basin (Tresco)
1 Km
0
1 Km
2 Km
(30/10/1968)

<Site Name> Vartuli/Musgrove
<Synonyms>

Spatial

<Location description> 3 kilometres NW of Mildura, Victoria and 5 kilometres east of Merbein, Victoria

<Located in Murray Trench> Yes

<Location 1:250 000> Mildura

<Location 1:100 000> Mildura 7329

<Zone> 54

<Coordinates easting (AMG)> 603600

<Coordinates northing (AMG)> 6219500

<State> Victoria

General

<Year begun operation>

<Active/inactive>

<Full surface area (ha)> 18 ha

<Volume capacity (ML)>

<Full surface level (m AHD)>

<Groundwater level (m AHD)> < 32 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<Groundwater seepage/discharge>

<Average annual evaporation> 1980 mm/yr Class A pan Red Cliffs

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)>

<Sources of water to be disposed> Irrigation discharge

<Terminal/throughflow basin>

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Site Name> Vartuli/Musgrove
<Synonyms>

<Review of environmental impacts>

Engineering/Admin

<Public or private operation> Public

<Agency responsible>

<Project name> Vartuli/Musgrove

<Natural, modified natural or constructed>

<Modification type and degree>

Geological

<Site description and Geomorphology> Vartuli/Musgrove is located among a point bar complex along the Murray River.

<Subsurface investigations at site>

<Structural setting> The basin is southeast of the Koolong Trough and northwest of the Red Cliffs Ridge (Thorne, Hoxley, and Chaplin, 1990).

<Stratigraphic setting> The basin is floored by the Coonambidgal Formation (8 m), and is underlain by the Channel Sand (Monoman Formation) (8 m), the Parilla Sand (20 m), the Bookpurnong Beds, the Murray Group Limestone, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<Host formation> Coonambidgal Formation

<Host lithofacies> Fine sand, clayey sand, sandy clay, and clay

<Aquitard> Coonambidgal Formation, Bookpurnong Beds

<Aquitard lithofacies> Coonambidgal Formation: sandy clay and clay

<Aquifer> Channel Sand and Parilla Sand (Connected in trench)

<Aquifer lithofacies> Fine to coarse sand

<Comments>

<Site Name> Vartuli/Musgrove
<Synonyms>

Summary of Hydrodynamics

<Distance to Murray or tributary> <500 metres

<Head between basin and river/tributary> On floodplain

<Direction of groundwater flow in regional aquifer> North to northeast towards the river (RWC, 1991)

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Coonambidgal Formation: 5-10 metres

<kv and kh of aquifer>

<EC of aquifer> > 50,000 mg/L TDS (RWC, 1993a)

<Porosity of aquifer>

<Thickness of aquifer> Channel Sand and Parilla Sand: 30 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Not much is known about the basin, however if it is kept at or below river level, there should be little salinisation of the floodplain.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Site Name> Vartuli/Musgrove
<Synonyms>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

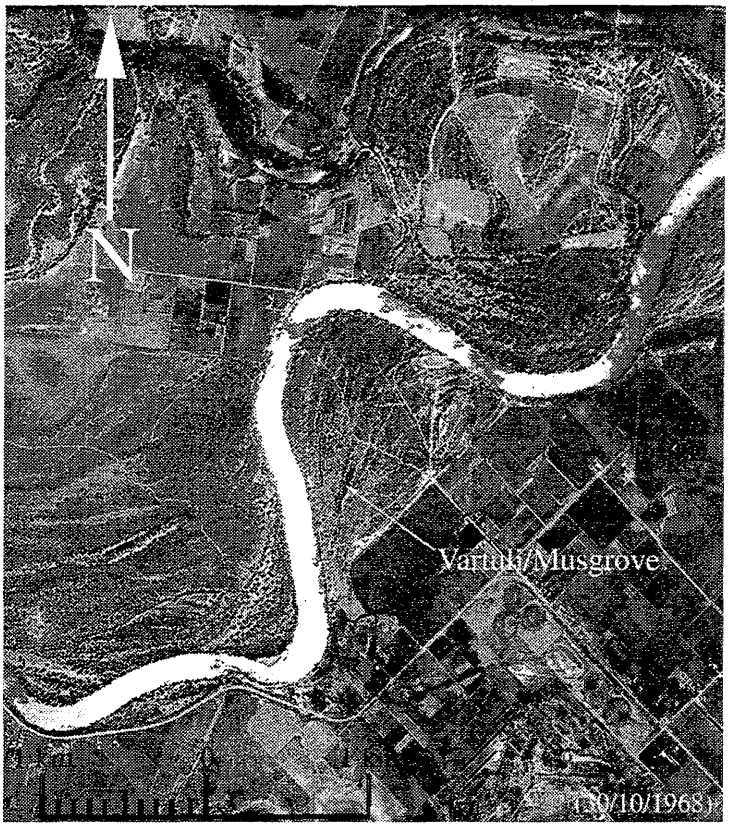
References Cited

Hoxley, G., 1991- Hydrogeological summary of wetland areas in the Sunraysia Salinity Management Plan Area., Rural Water Corporation, Groundwater Section, Technical note 1

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
Vartuli/Musgrove
1 km
(30/10/1968)

<Site Name> Wakefield
<Synonyms>

Spatial

<Location description>

<Located in Murray Trench> Yes

<Location 1:250 000>

<Location 1:100 000>

<Zone>

<Coordinates easting (AMG)>

<Coordinates northing (AMG)>

<State> Victoria

General

<Year begun operation>

<Active/inactive>

<Full surface area (ha)> 0.5 ha

<Volume capacity (ML)>

<Full surface level (m AHD)>

<Groundwater level (m AHD)>

<Groundwater seepage/discharge>

<Average annual evaporation>

<Volume disposed annually (ML/yr)>

<Salinity of water disposed (EC)>

<Range of salinity in basin (EC)> 784 mg/L (RWC, 1993a)

<Sources of water to be disposed> Private irrigation discharge

<Terminal/throughflow basin>

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> Wakefield
<Synonyms>

Engineering/Admin

<Public or private operation> Private

<Agency responsible>

<Project name> Wakefield

<Natural, modified natural or constructed>

<Modification type and degree>

Geological

<Site description and Geomorphology>

<Subsurface investigations at site>

<Structural setting>

<Stratigraphic setting>

<Host formation>

<Host lithofacies>

<Aquitard>

<Aquitard lithofacies>

<Aquifer>

<Aquifer lithofacies>

<Comments>

Summary of Hydrodynamics

<Distance to Murray or tributary>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer>

<kv of artificial floor>

<Site Name> Wakefield
<Synonyms>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard>

<kv and kh of aquifer>

<EC of aquifer> 20,000 mg/L TDS (RWC, 1993a)

<Porosity of aquifer>

<Thickness of aquifer>

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer>

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

<Site Name> Wargan 1
<Synonyms>

Spatial

<**Location description**> 18 kilometres SSE of Wentworth, NSW and 11 kilometres SW of Merbein, Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Wentworth 7229

<**Zone**> 54

<**Coordinates easting (AMG)**> 591700

<**Coordinates northing (AMG)**> 6209200

<**State**> Victoria

General

<**Year begun operation**> 1968 as part of the Lake Hawthorn Drainage Scheme, and 1979 as part of the Mildura-Merbein Groundwater Interception Scheme.

<**Active/inactive**> Active

<**Full surface area (ha)**> 56.825 ha

<**Volume capacity (ML)**> 393 ML

<**Full surface level (m AHD)**> 50 m AHD

<**Groundwater level (m AHD)**> 34 m AHD; ~35.5 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> Inflow/evaporation = 0.7; All basins 10,200 ML/year (Linke, Gato, and Northey, 1991)

<**Volume disposed annually (ML/yr)**> 5500 ML/yr (All basins)

<**Salinity of water disposed (EC)**> 100,000 EC

<**Range of salinity in basin (EC)**> 14,200-137,500 EC

<**Sources of water to be disposed**> Lake Ranfurly and Lake Hawthorn

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> Wargan 1
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Wargan Disposal Basins

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> Wargan Basin 1 is an elongate basin built with the longitudinal Woorinen dunes and surrounded by cleared mallee.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is southwest of the Wargan Fault and northwest of the Danyo Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (2 m), and is underlain by the Blanchetown Clay (22 m), the Parilla Sand (50 m), the Bookpurnong/Geera Clay/Winnambool Formation (100 m), the Murray Group Limestone, and the Renmark Group (Geology interpreted from Throne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay, sandy silt, sandy clay, and sand; Upper Parilla Sand: Pisolitic ferruginous duricrust and/or clayey sand

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**> Net evaporative capacity 10,200 ML/yr for all Wargan Basins

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 14.5 kilometres

<**Head between basin and river/tributary**>

<Site Name> Wargan 1
<Synonyms>

<**Direction of groundwater flow in regional aquifer**> West-southwest

<**kv of artificial floor**>

<**kv and kh of host**> Woorinen Formation: Kh = 40-50 m/day (Transmissivity 190 m^2/day; SR&WSC, 1974)

<**kv and kh of aquitard**> Blanchetown Clay: Kv = 5 x 10^{-2} to 10^{-3} m/day (Duncan and Linke, 1990)

<**Thickness of aquitard**> Blanchetown Clay: 22 metres, Upper Parilla Sand: 5-7 metres

<**kv and kh of aquifer**> Parilla Sand: Kh = 1.6 to 58 m/day (Duncan and Linke, 1990)

<**EC of aquifer**> >50,000 mg/L TDS (RWC, 1993)

<**Porosity of aquifer**>

<**Thickness of aquifer**> 50 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> Leakage from the Wargan Basins is thought to be unimportant for three reasons. First, the Wargan Basins have a very high evaporative capacity due to the large surface area of the basins. Present input is less (5500 ML) than the evaporative capacity (10,200 ML), which results in the basins being normally dry. Second, Wargan Basin 1 is separated from the Parilla Sand by a 20 metre thick deposit of the Blanchetown Clay, a low permeability aquitard. Third, the watertable is 15 metres below the surface of the ground and groundwater flow is to the west into the mallee country, away from the irrigation area.

However, over the past 20 years of operation a 2 metre high mound within the Parilla Sand has developed. Modelling, suggests that leakage from the basin is 0.8 mm/day (292 mm/yr or 165 ML/yr) of which 0.2 mm/day (73 mm/yr or 41 ML/yr) enters the Parilla Sand, the remainder forms a perched aquifer within the Blanchetown Clay (Irymple Member?) on top of the Upper Parilla Sand. The mound will continue to grow over the next 200 years (along with the irrigation mound), until it reaches Boy Creek, where discharge will occur into the creek and from there into the river. The salt load to the Murray River is expected to increase from 34 to 120 tonnes/day depending on the amount of groundwater accession, with the Wargan Basins contributing 5 to 10 tonnes/day (although possibly more depending recharge to Parilla from Wargan). The mound within the Blanchetown Clay could either cause salinity problems of its own (depending on continuity of the aquifer), act as storage, or simply allow recharge to the Parilla Sand in high permeability zones. Future monitoring is required to address the ultimate behaviour of the basin (Duncan and Linke, 1990).

<**Hydraulic linkage to surface runoff**> The Wargan Basins do not drain into the Murray River. However, lateral spreading of saline water into the perched aquifer of the Woorinen Formation has salinised the area around the basins which may contribute to saline flow into the Murray River.

<Site Name> Wargan 1
<Synonyms>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

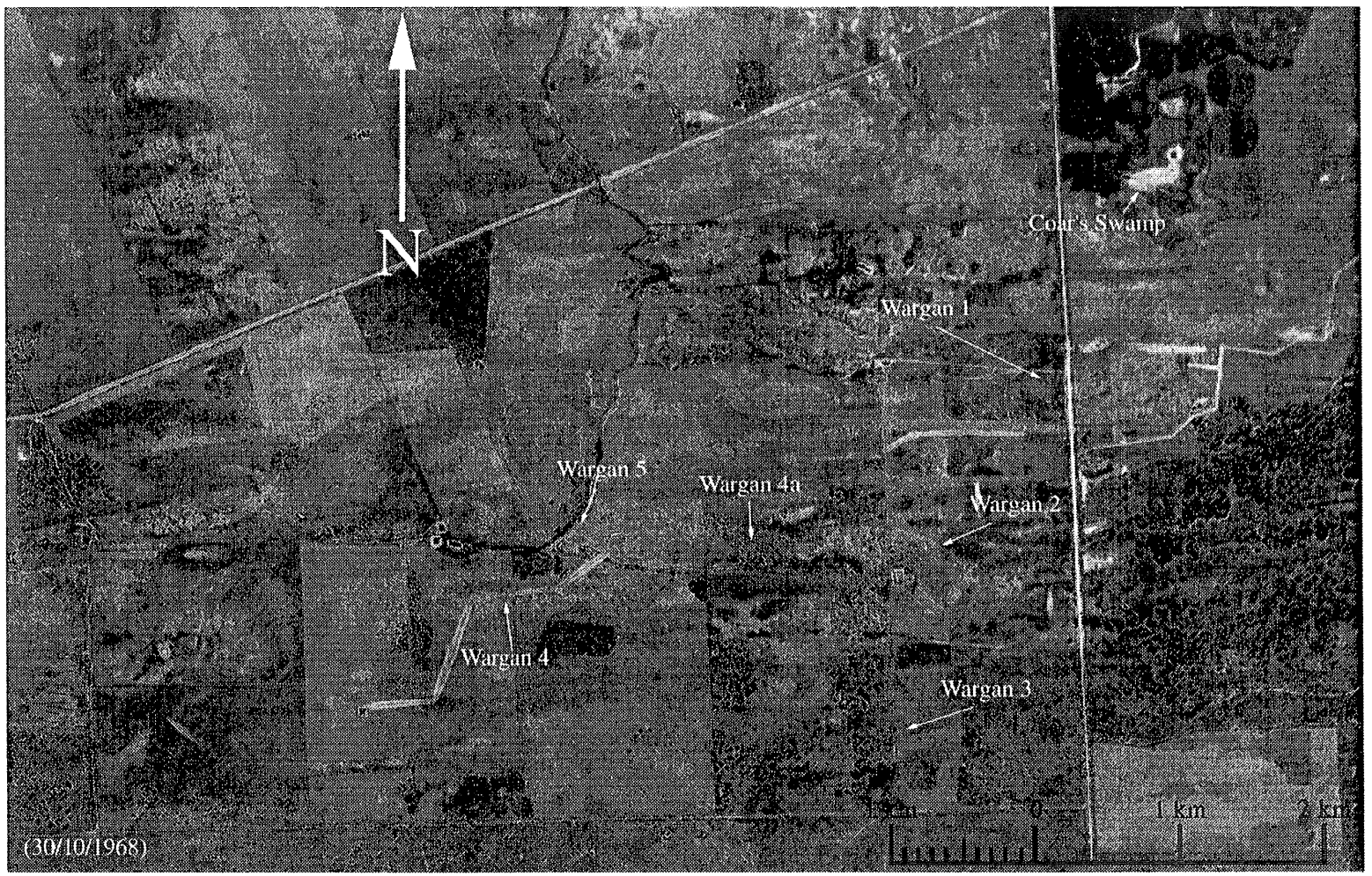
Linke, G.K., Gato, S., and Northey, P., 1991b- Evaluation of drainage disposal options for Merbein., Rural Water Commission of Victoria Report 1991/25

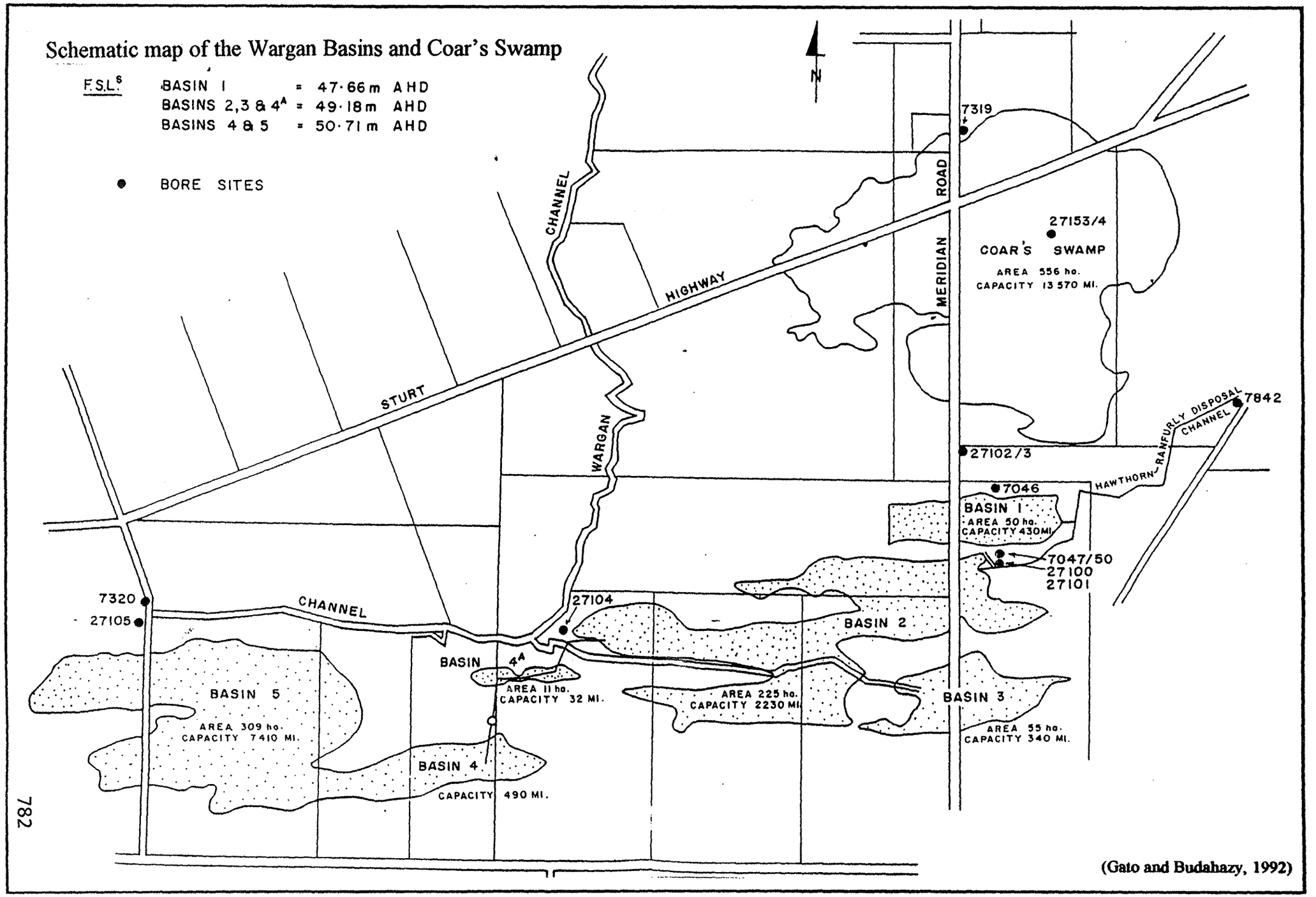
Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

State Rivers and Water Supply Commission, Victoria (SR&WSC), 1974- Sunraysia Salinity Investigations., Unpublished report

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
Coat's Swamp
Wargan 1
Wargan 5
Wargan 4a
Wargan 2
Wargan 4
Wargan 3
1 km
0
1 km
2 km
(30/10/1968)



(Gato and Budahazy, 1992)

<Site Name> Wargan 2
<Synonyms>

Spatial

<Location description> 15 kilometres south of Yelta, Victoria and 17 kilometres SSE of Wentworth, NSW

<Located in Murray Trench> No

<Location 1:250 000> Mildura

<Location 1:100 000> Wentworth 7229

<Zone> 54

<Coordinates easting (AMG)> 590400

<Coordinates northing (AMG)> 6207900

<State> Victoria

General

<Year begun operation> 1968

<Active/inactive> Active

<Full surface area (ha)> 238.69 ha

<Volume capacity (ML)> 1735 ML

<Full surface level (m AHD)> 49.18 m AHD

<Groundwater level (m AHD)> 34 m AHD

<Groundwater seepage/discharge> Seepage

<Average annual evaporation> Inflow/evaporation = 0.7

<Volume disposed annually (ML/yr)> 5500 ML/yr (all basins)

<Salinity of water disposed (EC)> 100,000 EC

<Range of salinity in basin (EC)> 4400-39,000 EC

<Sources of water to be disposed> Lake Ranfurly and Lake Hawthorn

<Terminal/throughflow basin> Throughflow

<Range of elevation of lake surface with disposal>

<Lining/treatment of base> None

<Review of environmental impacts>

<Site Name> Wargan 2
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Wargan Disposal Basins

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> Wargan Basin 2 is an elongate basin built with the longitudinal Woorinen dunes and surrounded by cleared mallee.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is southwest of the Wargan Fault and northwest of the Danyo Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (2 m), and underlain by the Blanchetown Clay (30 m), the Parilla Sand, (50 m), the Bookpurnong Beds/Geera Clay/Winnambool Formation (100 m), the Murray Group Limestone, and the Renmark Beds (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay, silty clay, sandy clay, and sand (Thorne, Hoxley, and Chaplin, 1990); Upper Parilla Sand: Clayey sand and pisolitic ferruginous duricrust (Karoonda Surface)

<**Aquifer**> Parilla Sand, Chowilla Sand (Irymple member of Blanchetown Clay)

<**Aquifer lithofacies**> Parilla Sand: Sand; Chowilla Sand: Clayey sand and medium clay (Bore log 27014, RWC)

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**>

<Site Name> Wargan 2
<Synonyms>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> West-southwest

<kv of artificial floor>

<kv and kh of host> Woorinen Formation: Kh = 40-50 m/day (Transmissivity 190 m^2/day; SR&WSC, 1974)

<kv and kh of aquitard> Blanchetown Clay: 5 x 10^{-2} to 10^{-3} m/day (Duncan and Linke, 1992)

<Thickness of aquitard> Blanchetown Clay: 30 metres; Upper Parilla Sand: 5-7 metres

<kv and kh of aquifer> Parilla Sand: Kh = 1.6 to 58 m/day (Duncan and Linke, 1992)

<EC of aquifer> Parilla Sand: > 50,000 mg/L TDS (RWC database); 40-60,000 EC (Duncan and Linke, 1992)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 50 metres; Chowilla Sand: 1-7 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Leakage from the Wargan Basins is thought to be non significant (0.8 mm/day) for three reasons. First, the Wargan Basins have a very high evaporative capacity due to the large surface area of the basins. Present input is less (5500 ML) than the evaporative capacity (10,200 ML) which results in the basins being normally dry. Second, Wargan Basin 2, is separated from the Parilla Sand by a 30 metre thick deposit of the Blanchetown Clay, which is a low permeability aquitard. Third, the watertable is 15 metres below the surface of the ground and groundwater flow is to the west into the mallee country away from the irrigation area. Thus any build up of high salinity groundwater would be isolated.

However, over the past 20 years of operation a 2 metre high mound within the Parilla Sand has developed. Modelling, suggests that leakage from the basin is 0.8 mm/day (292 mm/yr or 697 ML/yr)) of which 0.2 mm/day (73 mm/yr or 174 ML/yr) enters the Parilla Sand the remainder forms a perched aquifer within the Blanchetown Clay (Irymple Member?) on top of the Upper Parilla Sand. The mound will continue to grow over the next 200 years (along with the irrigation mound) until it reaches Boy Creek where discharge will occur into the creek and from there into the river. Salt load to the Murray River are expected to increase from 34 to 120 tonnes/day depending on the amount of groundwater accession within the Wargan Basin contributing 5 to 10 tonnes/day (although possibly more depending recharge to Parilla from Wargan). The mound within the Blanchetown Clay could either cause salinity problems of its own (depending on continuity of aquifer), act as storage, or simply allow recharge to the Parilla Sand in high permeability zones. Future monitoring is required to address the ultimate behaviour of the basin (Duncan and Linke, 1990).

<Hydraulic linkage to surface runoff> The Wargan Basins do not drain into the Murray River. However, lateral spreading of saline water into the perched aquifer of the Woorinen Formation has salinised the area around the basins, which may contribute to saline flow into the Murray River.

<Site Name> Wargan 2
<Synonyms>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

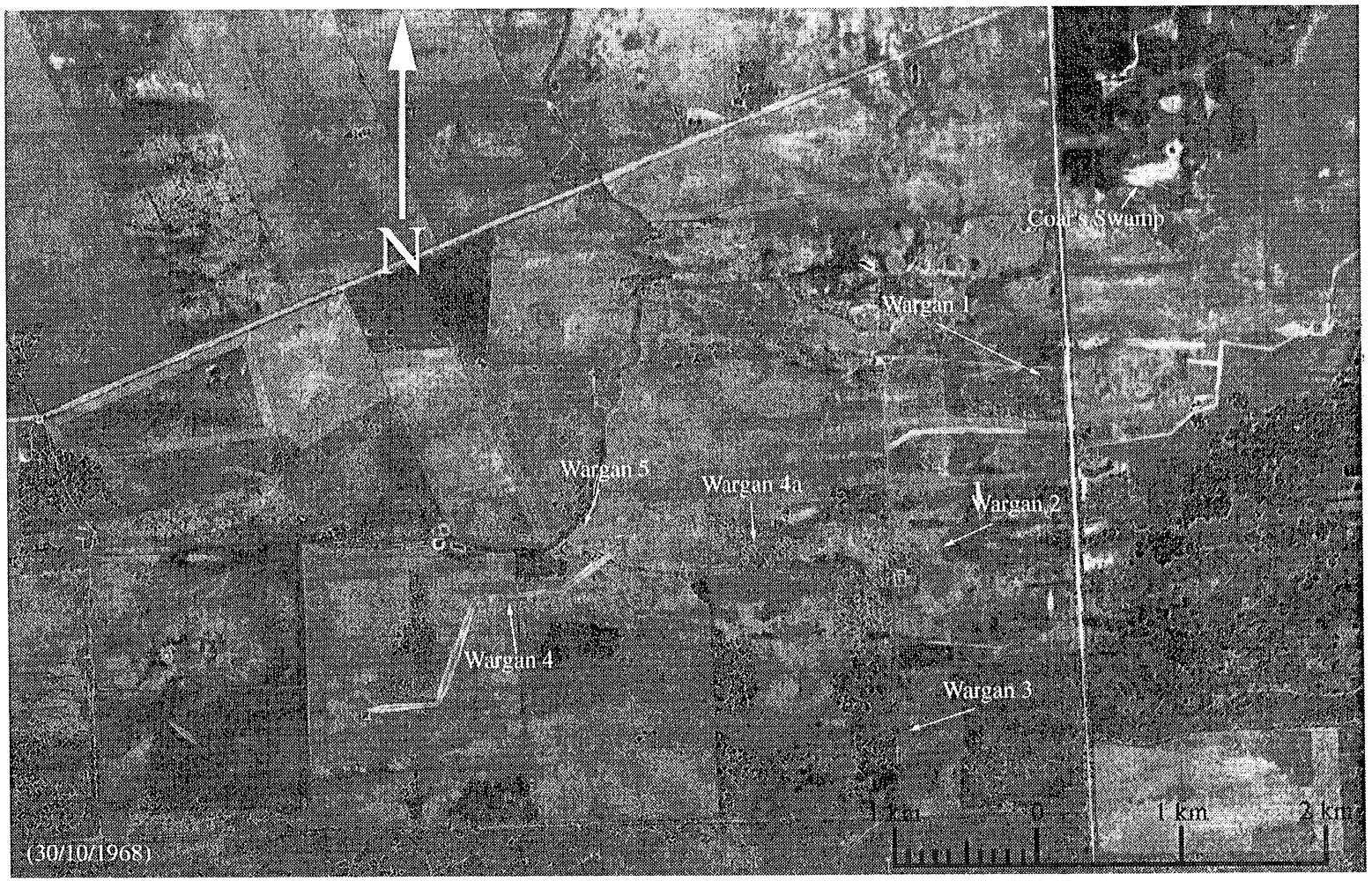
Linke, G.K., Gato, S., and Northey, P., 1991b- Evaluation of drainage disposal options for Merbein., Rural Water Commission of Victoria Report 1991/25

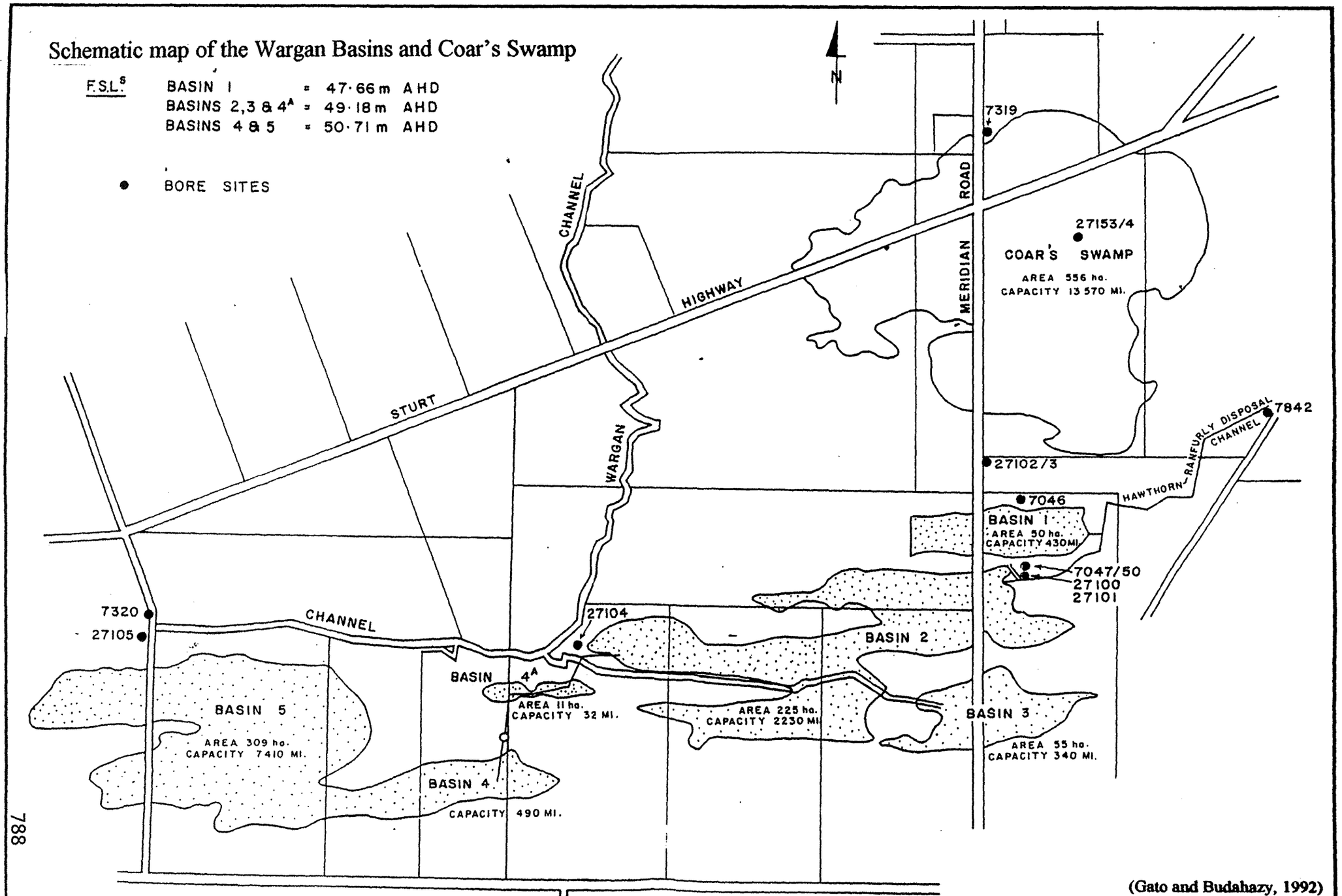
Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

State Rivers and Water Supply Commission, Victoria (SR&WSC), 1974- Sunraysia Salinity Investigations., Unpublished report

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
Coal's Swamp
Wargan 1
Wargan 5
Wargan 4a
Wargan 2
Wargan 4
Wargan 3
1 km
0
1 km
2 km
(30/10/1968)



(Gato and Budahazy, 1992)

<Site Name> Wargan 3
<Synonyms>

Spatial

<**Location description**> 15 kilometres south of Yelta, Victoria and 17 kilometres SSE of Wentworth, NSW

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 592000

<**Coordinates northing (AMG)**> 6207700

<**State**> Victoria

General

<**Year begun operation**> 1968 as part of Lake Hawthorn Drainage Scheme and 1979 as part of the Mildura-Merbein Groundwater Interception Scheme

<**Active/inactive**> Active

<**Full surface area (ha)**> 57.2 ha

<**Volume capacity (ML)**> 211 ML

<**Full surface level (m AHD)**> 50 m AHD

<**Groundwater level (m AHD)**> 34 m AHD (RWC, 1993); 35 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> Inflow/evaporation = 0.7; All basin 10,200 ML/yr (Linke, Gato, and Northey, 1991b)

<**Volume disposed annually (ML/yr)**> 5500 ML/yr (all basins)

<**Salinity of water disposed (EC)**> 100,000 EC

<**Range of salinity in basin (EC)**> 8400-46200 EC

<**Sources of water to be disposed**> Lake Hawthorn Scheme and Merbein Irrigation Area

<**Terminal/throughflow basin**> Throughflow

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> Wargan 3
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Wargan Disposal Basins

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> Wargan Basin 3 is an elongate basin built with the longitudinal Woorinen dunes and surrounded by cleared mallee.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is southwest of the Wargan Fault and northwest of the Danyo Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (2 m), and underlain by the Blanchetown Clay (25-30 m), the Parilla Sand, (50 m), the Bookpurnong Beds/Geera Clay/Winnambool Formation (100 m), the Murray Group Limestone, and the Renmark Beds (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay, silty clay, sandy clay, and sand (Thorne, Hoxley, and Chaplin, 1990); Upper Parilla Sand: Clayey sand and pisolitic ferruginous duricrust (Karoonda Surface)

<**Aquifer**> Parilla Sand, Chowilla Sand (Irymple member of Blanchetown Clay)

<**Aquifer lithofacies**> Parilla Sand: Sand; Chowilla Sand: Clayey sand and medium clay (Bore log 27014, RWC)

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**>

<Site Name> Wargan 3
<Synonyms>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> West-southwest

<kv of artificial floor>

<kv and kh of host> Woorinen Formation: Kh = 40-50 m/day (Transmissivity 190 m^2/day; SR&WSC, 1974)

<kv and kh of aquitard> Blanchetown Clay: 5 x 10^{-2} to 10^{-3} m/day (Duncan and Linke, 1992)

<Thickness of aquitard> Blanchetown Clay: 25-30 metres; Upper Parilla Sand: 5-7 metres

<kv and kh of aquifer> Parilla Sand: Kh = 1.6 to 58 m/day (Duncan and Linke, 1992)

<EC of aquifer> Parilla Sand: > 50,000 mg/L TDS (RWC database); 40-60,000 EC (Duncan and Linke, 1992)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 50 metres; Chowilla Sand: 1-7 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Leakage from the Wargan Basins is thought to be non significant (0.8 mm/day) for three reasons. First, the Wargan Basins have a very high evaporative capacity due to the large surface area of the basins. Present input is less (5500 ML) than the evaporative capacity (10,200 ML), which results in the basins being normally dry. Second, Wargan Basin 3 is separated from the Parilla Sand by a 25-30 metre thick deposit of the Blanchetown Clay which is a low permeability aquitard. Third, the watertable is 15 metres below the surface of the ground and groundwater flow is to the west into the mallee country away from the irrigation area. Thus any build up of high saline groundwater would be isolated.

However, over the past 20 years of operation a 2 metre high mound within the Parilla Sand has developed. Modelling suggests that leakage from the basin is 0.8 mm/day (292 mm/yr or 167 ML/yr) of which 0.2 mm/day (73 mm/yr or 42 ML/yr) enters the Parilla Sand, the remainder forms a perched aquifer within the Blanchetown Clay (Irymple Member?) on top of the Upper Parilla Sand. The mound will continue to grow over the next 200 years (along with the irrigation mound) until it reaches Boy Creek where discharge will occur into the creek and from there into the river. Salt load to the Murray River is expected to increase from 34 to 120 tonnes/day depending on the amount of groundwater accession with Wargan Basin contributing 5 to 10 tonnes/day (although possibly more depending recharge to Parilla from Wargan). The mound within the Blanchetown Clay could either cause salinity problems of its own (depending on continuity of aquifer), act as storage, or simply allow recharge to the Parilla Sand in high permeability zones. Future monitoring is required to address the ultimate behaviour of the basin (Duncan and Linke, 1990).

<Site Name> Wargan 3
<Synonyms>

<Hydraulic linkage to surface runoff> The Wargan Basins do not drain into the Murray River. However, lateral spreading of saline water into the perched aquifer of the Woorinen Formation has salinised the area around the basins which may contribute to saline flow into the Murray River.

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

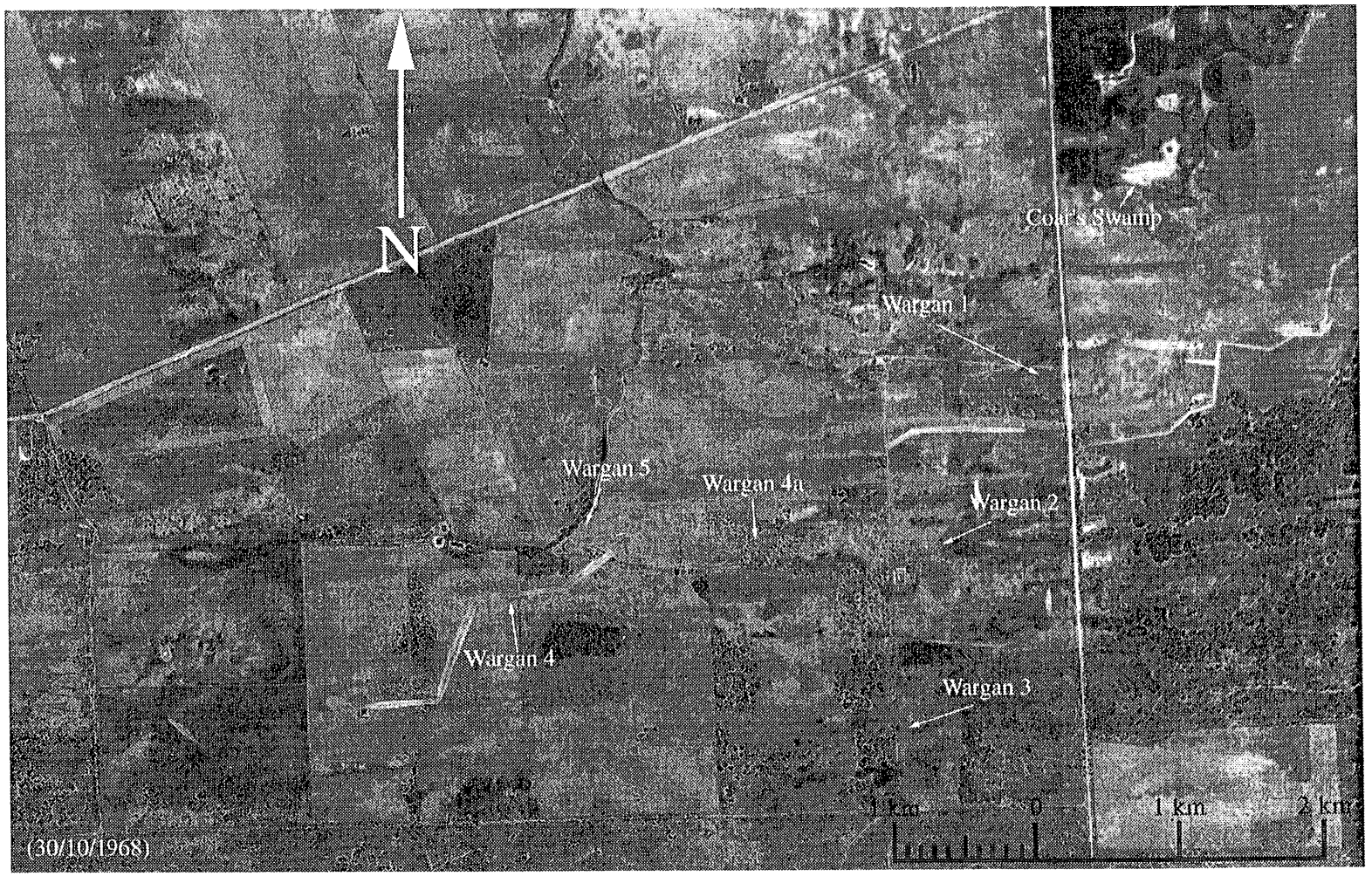
Linke, G.K., Gato, S., and Northey, P., 1991b- Evaluation of drainage disposal options for Merbein., Rural Water Commission of Victoria Report 1991/25

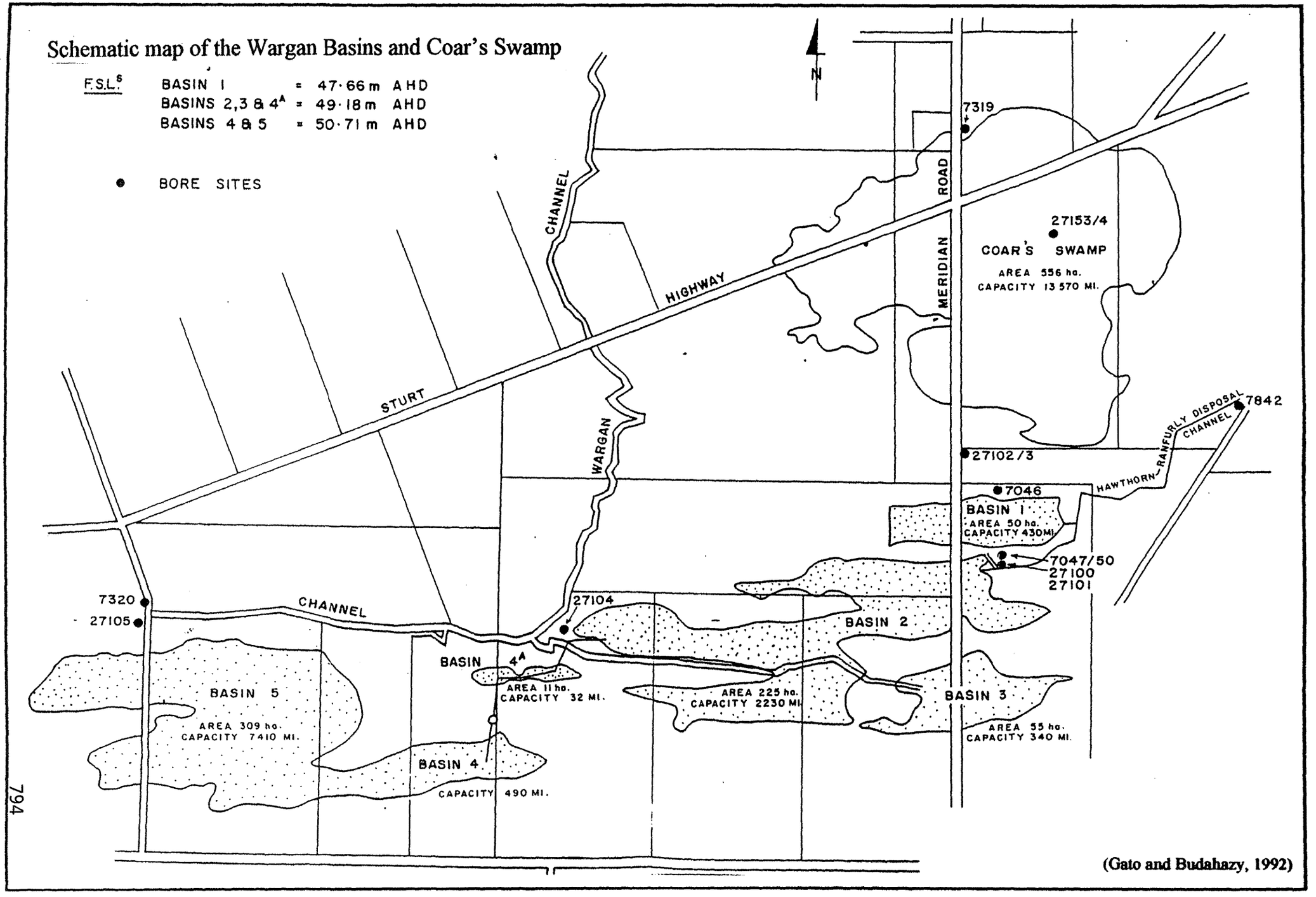
Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

State Rivers and Water Supply Commission, Victoria (SR&WSC), 1974- Sunraysia Salinity Investigations., Unpublished report

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
Cobb's Swamp
Wargan 1
Wargan 5
Wargan 4a
Wargan 2
Wargan 4
Wargan 3
1 km
0
1 km
2 km
(30/10/1968)



(Gato and Budahazy, 1992)

<Site Name> Wargan 4
<Synonyms>

Spatial

<**Location description**> 15 kilometres south of Yelta, Victoria and 17 kilometresm SSE of Wentworth, NSW

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Wentworth 7229

<**Zone**> 54

<**Coordinates easting (AMG)**> 586600

<**Coordinates northing (AMG)**> 6207200

<**State**> Victoria

General

<**Year begun operation**> 1968 as part of Lake Hawthorn Drainage Scheme and 1979 as part of the Mildura-Merbein Groundwater Interception Scheme

<**Active/inactive**> Active

<**Full surface area (ha)**> 15.05 ha

<**Volume capacity (ML)**> 172 ML

<**Full surface level (m AHD)**> 50 m AHD

<**Groundwater level (m AHD)**> 34 m AHD (RWC, 1993); 33 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> Inflow/evaporation = 0.7; All basin 10,200 ML/yr (Linke, Gato, and Northey, 1991b)

<**Volume disposed annually (ML/yr)**> 5500 ML/yr (all basins)

<**Salinity of water disposed (EC)**> 100,000 EC

<**Range of salinity in basin (EC)**> 8900-74,000 EC

<**Sources of water to be disposed**> Lake Hawthorn Scheme and Merbein Irrigation Area

<**Terminal/throughflow basin**> Throughflow

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> Wargan 4
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Wargan Disposal Basins

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> Wargan Basin 4 is an elongate basin built with the longitudinal Woorinen dunes and surrounded by cleared mallee.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is southwest of the Wargan Fault and northwest of the Danyo Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (2 m), and underlain by the Blanchetown Clay (35-40 m), the Parilla Sand, (50 m), the Bookpurnong Beds/Geera Clay/Winnambool Formation (100 m), the Murray Group Limestone, and the Renmark Beds (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay, silty clay, sandy clay, and sand (Thorne, Hoxley, and Chaplin, 1990); Upper Parilla Sand: Clayey sand and pisolitic ferruginous duricrust (Karoonda Surface)

<**Aquifer**> Parilla Sand, Chowilla Sand (Irymple member of Blanchetown Clay)

<**Aquifer lithofacies**> Parilla Sand: Sand; Chowilla Sand: Clayey sand and medium clay (Bore log 27014, RWC)

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**>

<Site Name> Wargan 4
<Synonyms>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> West-southwest

<kv of artificial floor>

<kv and kh of host> Woorinen Formation: Kh = 40-50 m/day (Transmissivity 190 m^2/day; SR&WSC, 1974)

<kv and kh of aquitard> Blanchetown Clay: 5 x 10^{-2} to 10^{-3} m/day (Duncan and Linke, 1992)

<Thickness of aquitard> Blanchetown Clay: 35-40 metres; Upper Parilla Sand: 5-7 metres

<kv and kh of aquifer> Parilla Sand: Kh = 1.6 to 58 m/day (Duncan and Linke, 1992)

<EC of aquifer> Parilla Sand: > 50,000 mg/L TDS (RWC database); 40-60,000 EC (Duncan and Linke, 1992)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 50 metres; Chowilla Sand: 1-7 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Leakage from the Wargan Basins is thought to be non significant (0.8 mm/day) for three reasons. First, the Wargan Basins have a very high evaporative capacity due to the large surface area of the basins. Present input is less (5500 ML) than the evaporative capacity (10,200 ML), which results in the basins being normally dry. Second, Wargan Basin 4, is separated from the Parilla Sand by a 35-40 metre thick deposit of the Blanchetown Clay, a low permeability aquitard. Third, the watertable is 15 metres below the surface of the ground and groundwater flow is to the west into the mallee country away from the irrigation area. Thus any build up of high saline groundwater would be isolated.

However, over the past 20 years of operation a 2 metre high mound within the Parilla Sand has developed. Modelling, suggests that leakage from the basin is 0.8 mm/day (292 mm/yr or 44 ML/yr) of which 0.2 mm/day (73 mm/yr or 11 ML/yr) enters the Parilla Sand, the remainder forms a perched aquifer within the Blanchetown Clay (Irymple Member?) on top of the Upper Parilla Sand. The mound will continue to grow over the next 200 years (along with the irrigation mound) until it reaches Boy Creek where it will discharge and from there into the river. Salt load to the Murray River is expected to increase from 34 to 120 tonnes/day depending on the amount of groundwater accession, with Wargan Basin contributing 5 to 10 tonnes/day (although possibly more depending recharge to Parilla from Wargan). The mound within the Blanchetown Clay could either cause salinity problems of its own (depending on continuity of aquifer), act as storage, or simply allow recharge to the Parilla Sand in high permeability zones. Future monitoring is required to address the ultimate behaviour of the basin (Duncan and Linke, 1990).

<Site Name> Wargan 4
<Synonyms>

<Hydraulic linkage to surface runoff> The Wargan Basins do not drain into the Murray River. However, lateral spreading of saline water into the perched aquifer of the Woorinen Formation has salinised the area around the basins which may contribute to saline flow into the Murray River.

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

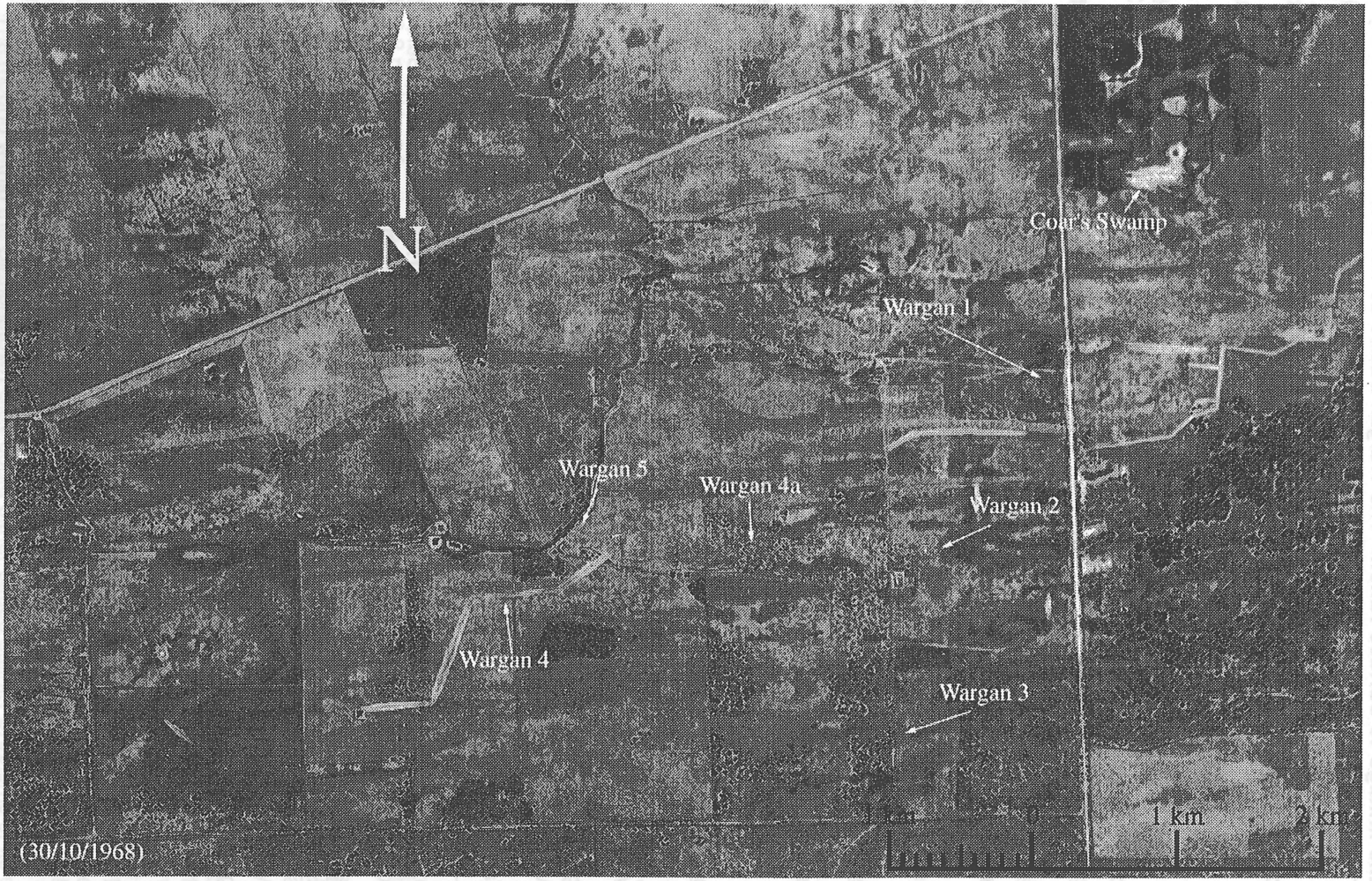
Linke, G.K., Gato, S., and Northey, P., 1991b- Evaluation of drainage disposal options for Merbein., Rural Water Commission of Victoria Report 1991/25

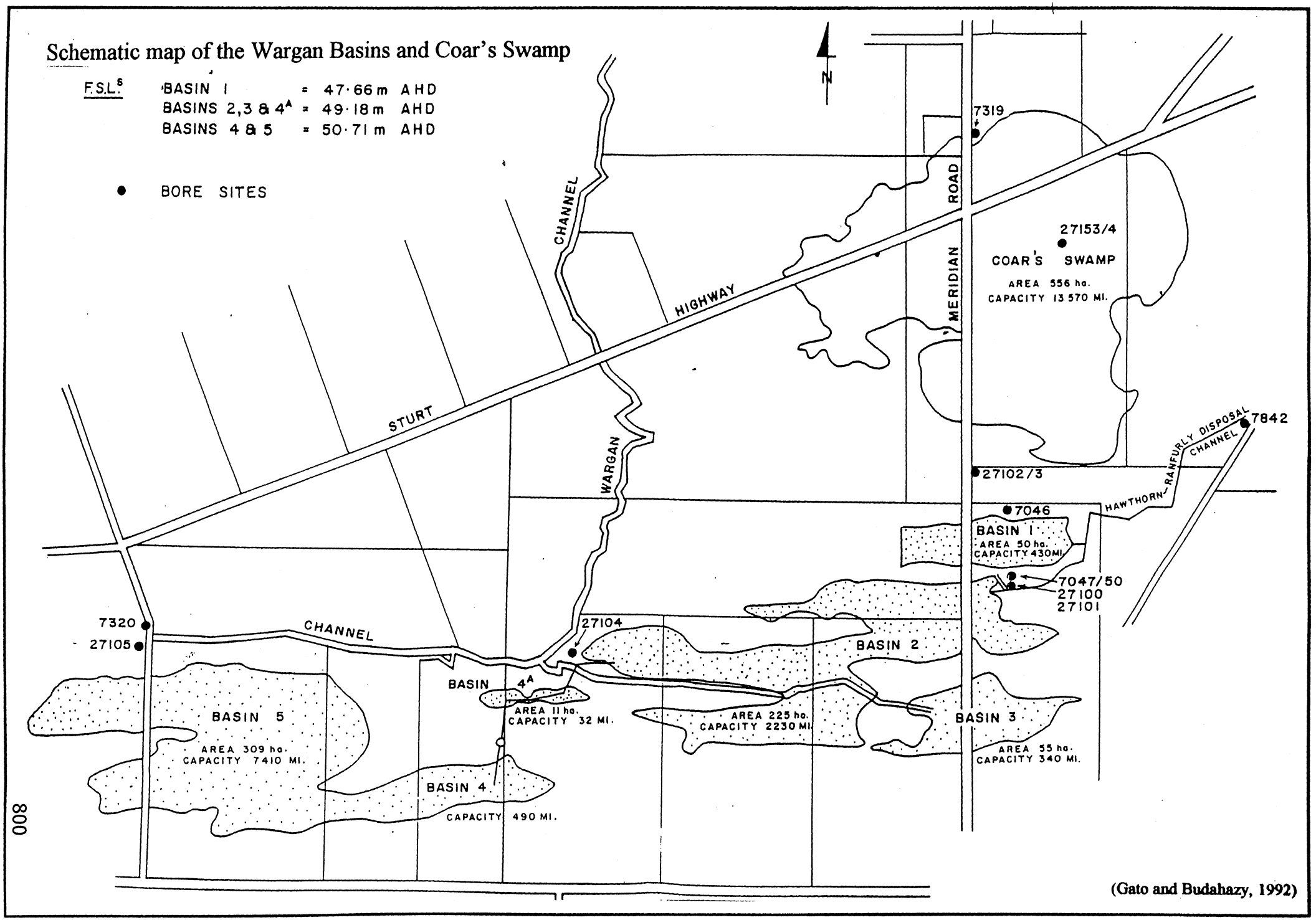
Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

State Rivers and Water Supply Commission, Victoria (SR&WSC), 1974- Sunraysia Salinity Investigations., Unpublished report

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
Coar's Swamp
Wargan 1
Wargan 5
Wargan 4a
Wargan 2
Wargan 4
Wargan 3
1 km
2 km
(30/10/1968)



(Gato and Budahazy, 1992)

<Site Name> Wargan 4a
<Synonyms>

Spatial

<**Location description**> 15 kilometres south of Yelta, Victoria and 17 kilometres SSE of Wentworth, NSW

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Wentworth 7229

<**Zone**> 54

<**Coordinates easting (AMG)**> 590000

<**Coordinates northing (AMG)**> 6207200

<**State**> Victoria

General

<**Year begun operation**> 1968 as part of Lake Hawthorn Drainage Scheme and 1979 as part of the Mildura-Merbein Groundwater Interception Scheme

<**Active/inactive**> Active

<**Full surface area (ha)**> 18.4 ha

<**Volume capacity (ML)**> 65 ML

<**Full surface level (m AHD)**> 50 m AHD

<**Groundwater level (m AHD)**> 34 m AHD (RWC, 1993); 32.5 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> Inflow/evaporation = 0.7; All basin 10,200 ML/yr (Linke, Gato, and Northey, 1991b)

<**Volume disposed annually (ML/yr)**> 5500 ML/yr (all basins)

<**Salinity of water disposed (EC)**> 100,000 EC

<**Range of salinity in basin (EC)**> 7890 EC

<**Sources of water to be disposed**> Lake Hawthorn Scheme and Merbein Irrigation Area

<**Terminal/throughflow basin**>

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> Wargan 4a
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Wargan Disposal Basins

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> Wargan Basin 4a is an elongate basin built with the longitudinal Woorinen dunes and surrounded by cleared mallee.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is southwest of the Wargan Fault and northwest of the Danyo Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (2 m), and underlain by the Blanchetown Clay (35-40 m), the Parilla Sand, (50 m), the Bookpurnong Beds/Geera Clay/Winnambool Formation (100 m), the Murray Group Limestone, and the Renmark Beds (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay, silty clay, sandy clay, and sand (Thorne, Hoxley, and Chaplin, 1990); Upper Parilla Sand: Clayey sand and pisolitic ferruginous duricrust (Karoonda Surface)

<**Aquifer**> Parilla Sand, Chowilla Sand (Irymple member of Blanchetown Clay)

<**Aquifer lithofacies**> Parilla Sand: Sand; Chowilla Sand: Clayey sand and medium clay (Bore log 27014, RWC)

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**>

<Site Name> Wargan 4a
<Synonyms>

<**Head between basin and river/tributary**>

<**Direction of groundwater flow in regional aquifer**> West-southwest

<**kv of artificial floor**>

<**kv and kh of host**> Woorinen Formation: Kh = 40-50 m/day (Transmissivity 190 m^2/day; SR&WSC, 1974)

<**kv and kh of aquitard**> Blanchetown Clay: 5 x 10^{-2} to 10^{-3} m/day (Duncan and Linke, 1992)

<**Thickness of aquitard**> Blanchetown Clay: 35-40 metres; Upper Parilla Sand: 5-7 metres

<**kv and kh of aquifer**> Parilla Sand: Kh = 1.6 to 58 m/day (Duncan and Linke, 1992)

<**EC of aquifer**> Parilla Sand: > 50,000 mg/L TDS (RWC database); 40-60,000 EC (Duncan and Linke, 1992)

<**Porosity of aquifer**>

<**Thickness of aquifer**> Parilla Sand: 50 metres; Chowilla Sand: 1-7 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> Leakage from the Wargan Basins is thought to be non significant (0.8 mm/day) for three reasons. First, the Wargan Basins have a very high evaporative capacity due to the large surface area of the basins. Present input is less (5500 ML) than the evaporative capacity (10,200 ML) which results in the basins being normally dry. Second, Wargan Basin 4a is separated from the Parilla Sand by a 35-40 metre thick deposit of the Blanchetown Clay, a low permeability aquitard. Third, the watertable is 15 metres below the surface of the ground and groundwater flow is to the west into the mallee country away from the irrigation area. Thus any build up of high saline groundwater would be isolated.

However, over the past 20 years of operation a 2 metre high mound within the Parilla Sand has developed. Modelling, suggests that leakage from the basin is 0.8 mm/day (292 mm/yr or 54 ML/yr) of which 0.2 mm/day (73 mm/yr or 13 ML/yr) enters the Parilla Sand, the remainder forms a perched aquifer within the Blanchetown Clay (Irymple Member?) on top of the Upper Parilla Sand. The mound will continue to grow over the next 200 years (along with the irrigation mound) until it reaches Boy Creek where it will discharge and from there reach the river. The salt load to the Murray River is expected to increase from 34 to 120 tonnes/day depending on the amount of groundwater accession of Wargan Basin contributing 5 to 10 tonnes/day (although possibly more depending recharge to Parilla from Wargan). The mound within the Blanchetown Clay could either cause salinity problems of its own (depending on continuity of aquifer), act as storage, or simply allow recharge to the Parilla Sand in high permeability zones. Future monitoring is required to address the ultimate behaviour of the basin (Duncan and Linke, 1990).

<Site Name> Wargan 4a
<Synonyms>

<**Hydraulic linkage to surface runoff**> The Wargan Basins do not drain into the Murray River. However, lateral spreading of saline water into the perched aquifer of the Woorinen Formation has salinised the area around the basins which may contribute to saline flow into the Murray River.

<**Category - hydraulic stability**>

<**Category - degree of hydraulic isolation**>

<**Evaporation surplus**>

Interpretive 2

<**Ranking of sustainability**>

References Cited

Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

Linke, G.K., Gato, S., and Northey, P., 1991b- Evaluation of drainage disposal options for Merbein., Rural Water Commission of Victoria Report 1991/25

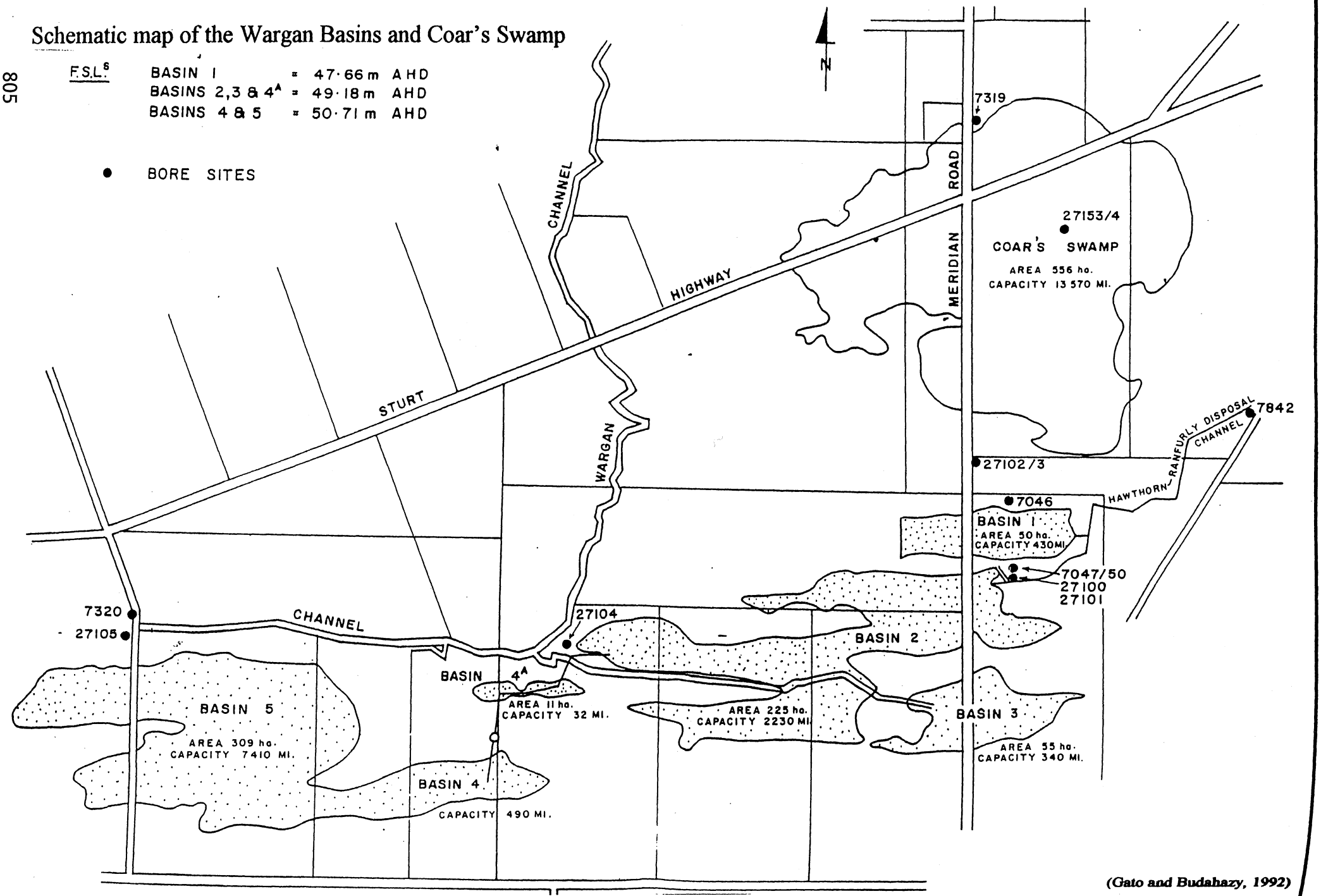
Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

State Rivers and Water Supply Commission, Victoria (SR&WSC), 1974- Sunraysia Salinity Investigations., Unpublished report

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.

Schematic map of the Wargan Basins and Coar's Swamp



(Gato and Budahazy, 1992)

<Site Name> Wargan 5
<Synonyms>

Spatial

<**Location description**> 15 kilometres south of Yelta, Victoria and 17 kilometres SSE of Wentworth, NSW

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Wentworth 7229

<**Zone**> 54

<**Coordinates easting (AMG)**> 585700

<**Coordinates northing (AMG)**> 6207800

<**State**> Victoria

General

<**Year begun operation**> 1968 as part of Lake Hawthorn Drainage Scheme and 1979 as part of the Mildura-Merbein Groundwater Interception Scheme

<**Active/inactive**> Active

<**Full surface area (ha)**> 300.69 ha

<**Volume capacity (ML)**> 2916 ML

<**Full surface level (m AHD)**> 50 m AHD

<**Groundwater level (m AHD)**> 34 m AHD (RWC, 1993); 31.5 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<**Groundwater seepage/discharge**> Seepage

<**Average annual evaporation**> Inflow/evaporation = 0.7; All basin 10,200 ML/yr (Linke, Gato, and Northey, 1991b)

<**Volume disposed annually (ML/yr)**> 5500 ML/yr (all basins)

<**Salinity of water disposed (EC)**> 100,000 EC

<**Range of salinity in basin (EC)**> 69000-75,000 EC

<**Sources of water to be disposed**> Lake Hawthorn Scheme and Merbein Irrigation Area

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> Wargan 5
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Wargan Disposal Basins

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> Wargan Basin 5 is an elongate basin built with the longitudinal Woorinen dunes and surrounded by cleared mallee.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is southwest of the Wargan Fault and northwest of the Danyo Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Woorinen Formation (2 m), and underlain by the Blanchetown Clay (42 m), the Parilla Sand, (50 m), the Bookpurnong Beds/Geera Clay/Winnambool Formation (100 m), the Murray Group Limestone, and the Renmark Beds (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Woorinen Formation

<**Host lithofacies**> Red silt and sand

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay, silty clay, sandy clay, and sand (Thorne, Hoxley, and Chaplin, 1990); Upper Parilla Sand: Clayey sand and pisolitic ferruginous duricrust (Karoonda Surface)

<**Aquifer**> Parilla Sand, Chowilla Sand (Irymple member of Blanchetown Clay)

<**Aquifer lithofacies**> Parilla Sand: Sand; Chowilla Sand: Clayey sand and medium clay (Bore log 27014, RWC)

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**>

<Site Name> Wargan 5
<Synonyms>

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> West-southwest

<kv of artificial floor>

<kv and kh of host> Woorinen Formation: Kh = 40-50 m/day (Transmissivity 190 m^2/day; SR&WSC, 1974)

<kv and kh of aquitard> Blanchetown Clay: 5 x 10^{-2} to 10^{-3} m/day (Duncan and Linke, 1992)

<Thickness of aquitard> Blanchetown Clay:42 metres; Upper Parilla Sand: 5-7 metres

<kv and kh of aquifer> Parilla Sand: Kh = 1.6 to 58 m/day (Duncan and Linke, 1992)

<EC of aquifer> Parilla Sand: > 50,000 mg/L TDS (RWC database); 40-60,000 EC (Duncan and Linke, 1992)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 50 metres; Chowilla Sand: 1-7 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Leakage from the Wargan Basins is thought to be non significant (0.8 mm/day) for three reasons. First, the Wargan Basins have a very high evaporative capacity due to the large surface area of the basins. Present input is less (5500 ML) than the evaporative capacity (10,200 ML), which results in the basins being normally dry. Second, Wargan Basin 5, is separated from the Parilla Sand, by a 42 metre thick deposit of the Blanchetown Clay, a low permeability aquitard. Third, the watertable is 15 metres below the surface of the ground and groundwater flow is to the west into the mallee country away from the irrigation area. Thus any build up of high saline groundwater would be isolated.

However, over the past 20 years of operation a 2 metre high mound within the Parilla Sand has developed. Modelling, suggests that leakage from the basin is 0.8 mm/day (292 mm/yr or 878 ML/yr) of which 0.2 mm/day (73 mm/yr or 219 ML/yr) enters the Parilla Sand while the remainder forms a perched aquifer within the Blanchetown Clay (Irymple Member?) on top of the Upper Parilla Sand. The mound will continue to grow over the next 200 years (along with the irrigation mound) until it reaches Boy Creek where it will discharge. The salt load to the Murray River is expected to increase from 34 to 120 tonnes/day depending on the amount of groundwater accession with Wargan Basin contributing 5 to 10 tonnes/day (although possibly more depending recharge to Parilla from Wargan). The mound within the Blanchetown Clay could either cause salinity problems of its own (depending on continuity of aquifer), act as storage, or simply allow recharge to the Parilla Sand in high permeability zones. Future monitoring is required to address the ultimate behaviour of the basin (Duncan and Linke, 1990).

<Hydraulic linkage to surface runoff> The Wargan Basins do not drain into the Murray River. However, lateral spreading of saline water into the perched aquifer of the Woorinen Formation has salinised the area around the basins which may contribute to saline flow into the Murray River.

<Site Name> Wargan 5
<Synonyms>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus>

Interpretive 2

<Ranking of sustainability>

References Cited

Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

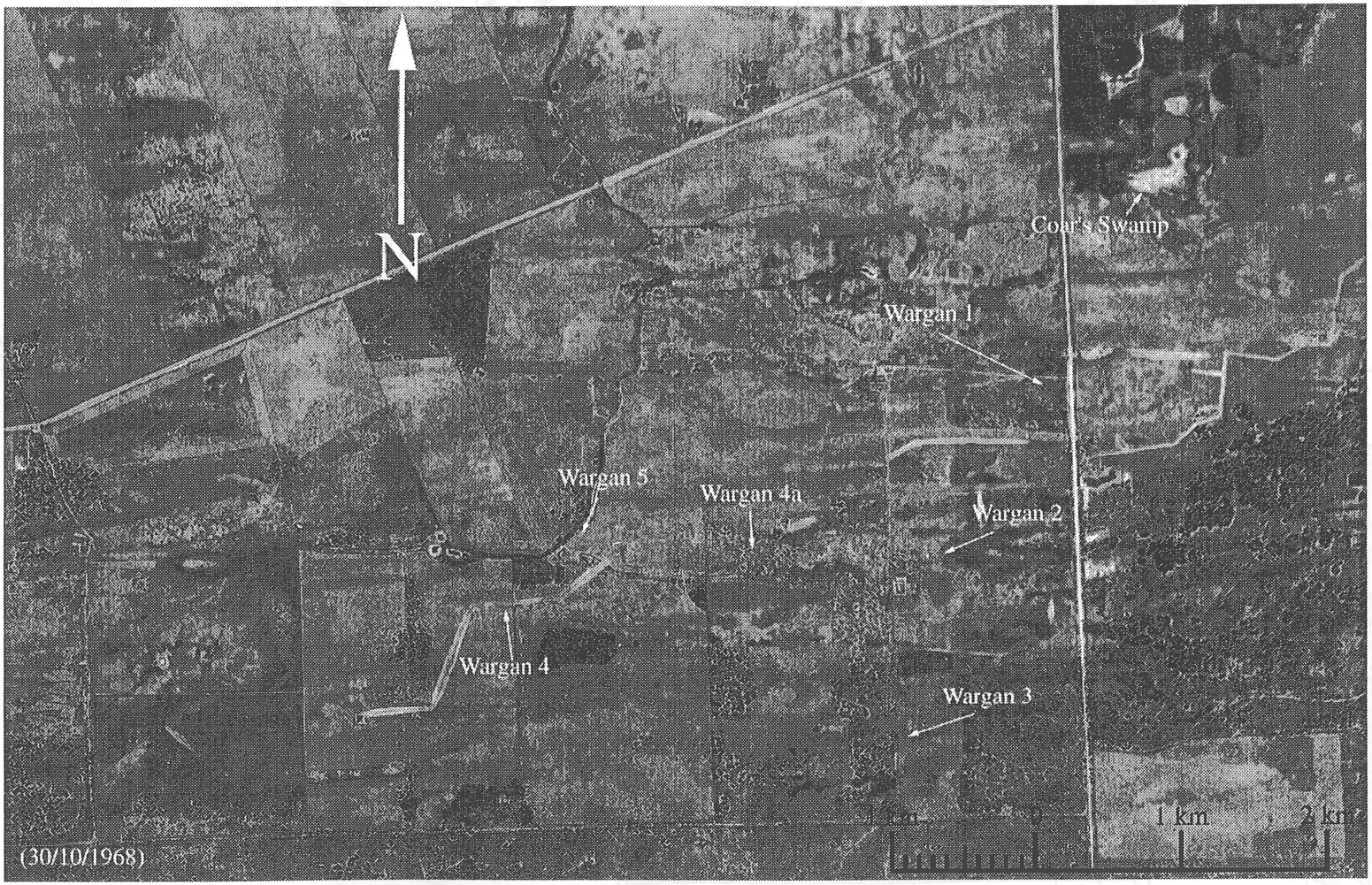
Linke, G.K., Gato, S., and Northey, P., 1991b- Evaluation of drainage disposal options for Merbein., Rural Water Commission of Victoria Report 1991/25

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

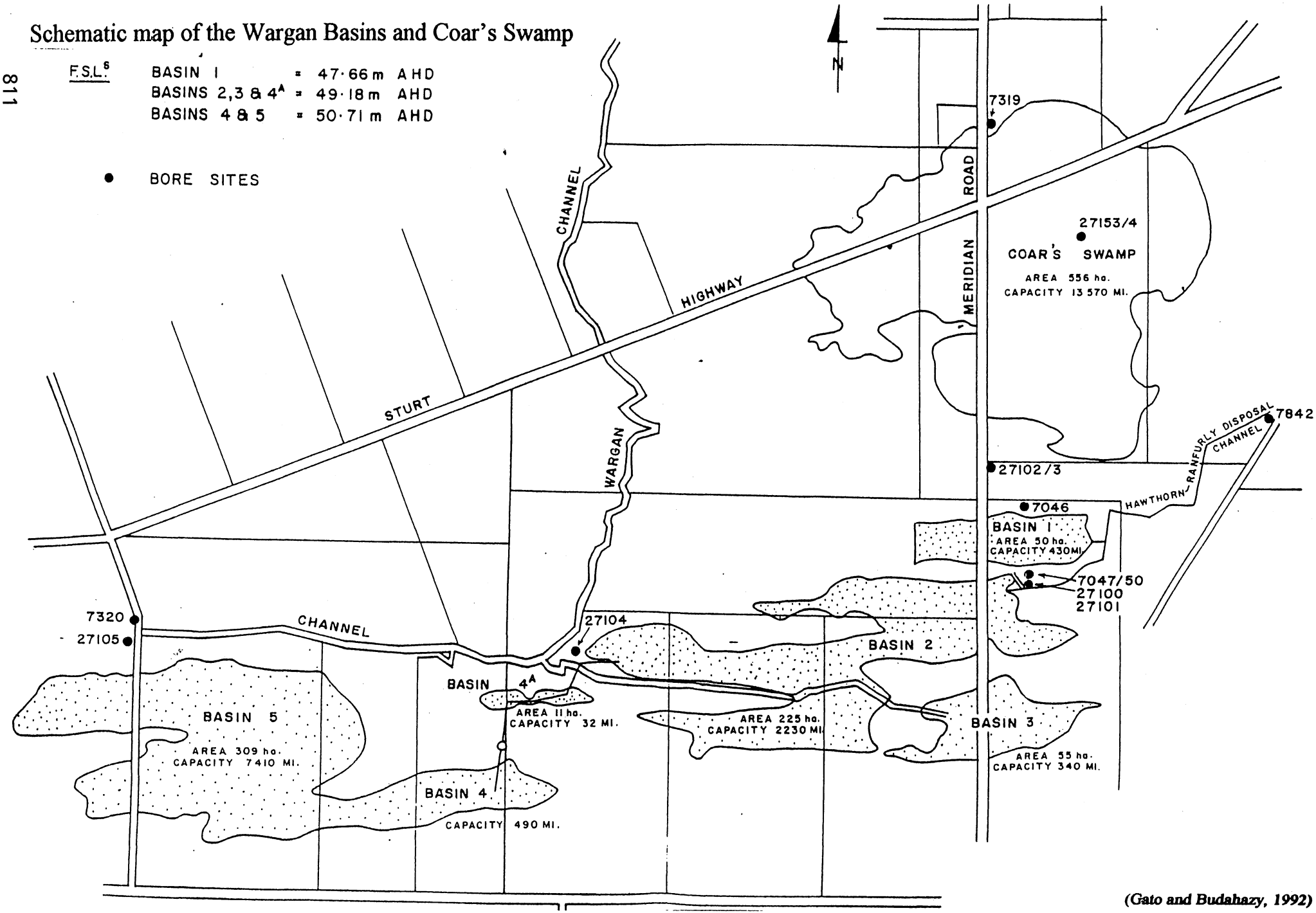
Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

State Rivers and Water Supply Commission, Victoria (SR&WSC), 1974- Sunraysia Salinity Investigations., Unpublished report

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
Coal's Swamp
Wargan 1
Wargan 5
Wargan 4a
Wargan 2
Wargan 4
Wargan 3
1 km
2 km
(30/10/1968)

Schematic map of the Wargan Basins and Coar's Swamp



(Gato and Budahazy, 1992)

<Site Name> Woorinen Holloways
<Synonyms>

Spatial

<**Location description**> 8 kilometres NNW of Woorinen, Victoria and 9 kilometres SE of Nyah, Victoria

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Swan Hill

<**Location 1:100 000**> Nyah 7527

<**Zone**> 54

<**Coordinates easting (AMG)**> 722500

<**Coordinates northing (AMG)**> 6099100

<**State**> Victoria

General

<**Year begun operation**> 1943

<**Active/inactive**> Active

<**Full surface area (ha)**> 181 ha

<**Volume capacity (ML)**> 1827 ML

<**Full surface level (m AHD)**> <63.0 m AHD (Estimated from Woorinen North)

<**Groundwater level (m AHD)**> 63.0 m AHD (estimated from Woorinen North)

<**Groundwater seepage/discharge**> Discharge

<**Average annual evaporation**> Inflow/evaporation < 0.2; 1400 mm/yr (Bromfield, 1953)

<**Volume disposed annually (ML/yr)**> 300 ML/yr

<**Salinity of water disposed (EC)**> 1143 EC

<**Range of salinity in basin (EC)**> 68,400-213,000 EC

<**Sources of water to be disposed**> Woorinen Irrigation Area

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> Woorinen Holloways
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Woorinen Irrigation Area

<**Natural, modified natural or constructed**> Modified natural

<**Modification type and degree**> Banks have been built

Geological

<**Site description and Geomorphology**> The basin consists of two sub-basins that have coalesced. It is bounded on the eastern side by a lunette indicating that it has acted as a discharge basin in the past. Air photos show that there is considerable salt accumulation in the eastern basin while the western basin is full, possibly due to is connection with Woorinen North in the south of the basin. The basin is surrounded and somewhat controlled by the longitudinal Woorinen Formation dunes that have acted to isolate the basin from the river.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located om the Nyah Ridge, northeast of the Yarraby Ridges (Parilla strandlines), and east of the Tyrrell Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Yamba Formation (2-3 m) and underlain by the Shepparton Formation (1-2 m), the Parilla Sand (60 m), and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990; and Lawrence and Macumber, 1974).

<**Host formation**> Yamba Formation

<**Host lithofacies**> Clay, lunettes and salt deposits

<**Aquitard**> Shepparton Formation

<**Aquitard lithofacies**> Clays and silts

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

<Site Name> Woorinen Holloways
<Synonyms>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 1 kilometre

<**Head between basin and river/tributary**>

<**Direction of groundwater flow in regional aquifer**> West away from the Murray River and towards Lake Tyrrell (O'Rourke, 1992)

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**>

<**Thickness of aquitard**> Shepparton Formation: 1-2 metres

<**kv and kh of aquifer**>

<**EC of aquifer**> > 50,000 mg/L TDS (RWC, 1993a)

<**Porosity of aquifer**>

<**Thickness of aquifer**> Parilla Sand: 60 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> The basin receives groundwater discharge from the Parilla Sand due to the high potentiometric surface within the Parilla. The rate of discharge is controlled by the thickness of the Shepparton Formation aquitard and whether it has been partially or completely eroded under the basin. This is presently unknown, but comparing the full level of the basin (63.0 m AHD estimated) with the top of Parilla structure contours (60 m AHD) and the regional thickness of the Shepparton Formation (8-10 m), we can estimate that at most 1-2 metres of Shepparton remains (interpreted from Thorne, Hoxley, and Chaplin, 1990). The discharge into the basin should cause few problems because of the high rate of evaporation within the basin (2534 ML/yr), however continued discharge and disposal to the basin may act to raise the local watertable within the Shepparton Formation.

<**Hydraulic linkage to surface runoff**>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus> 2534 ML/yr (181 ha x 1400 mm/yr evaporation)

Interpretive 2

<Ranking of sustainability>

References Cited

Bromfield, W.E., 1953- Woorinen South Drainage., State River and Water Supply Commission, Unpublished report

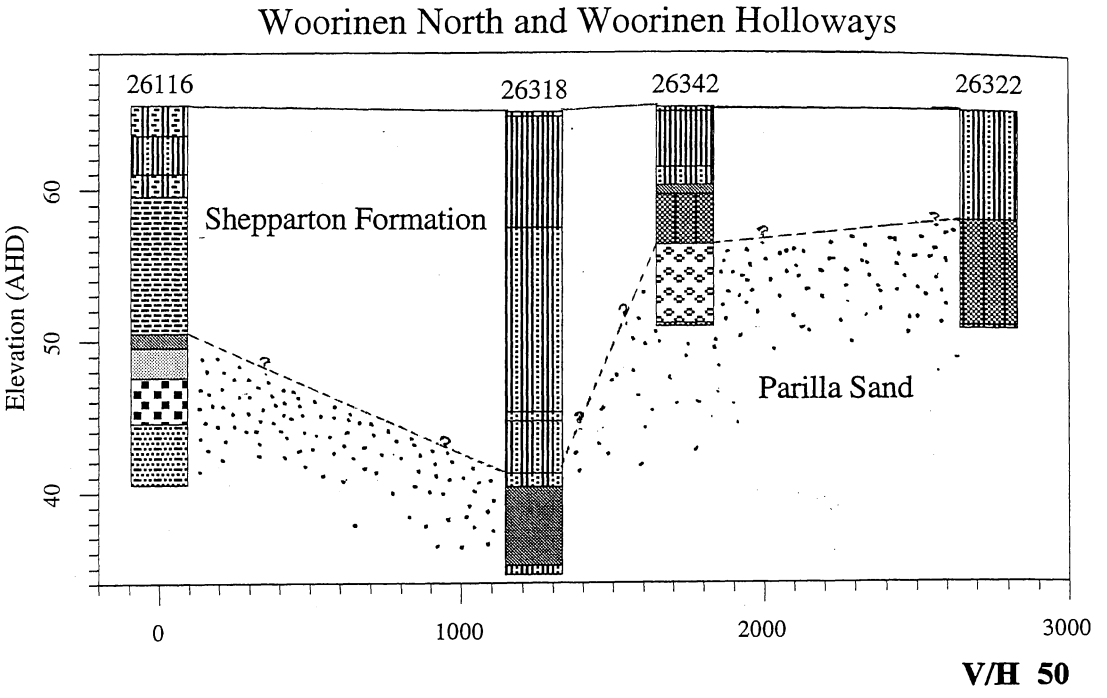
Lawrence, C.R., and Macumber, P.G., 1974- Swan Hill Geological Map (1:250,000 scale)., Geological Survey of Victoria

O'Rourke, M.E., et. al, Victorian Rural Water Commission, 1992- Swan Hill Hydrogeological Map (1:250,000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra Australia

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
Woorinen Holloways
Woorinen North
1 km
0
(14/11/1964)


Woorinen North and Woorinen Holloways
26116
26318
26342
26322
Shepparton Formation
Parilla Sand
Elevation (AHD)
60
50
40
0
1000
2000
3000
V/H 50


26116
26318
26342
26322

<Site Name> Woorinen Murrawee
<Synonyms>

Spatial

<**Location description**> 6 kilometres NW of Swan Hill, Victoria and 4 kilometres east of Woorinen, Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Swan Hill

<**Location 1:100 000**> Swan Hill 7627

<**Zone**> 54

<**Coordinates easting (AMG)**> 727900

<**Coordinates northing (AMG)**> 6091600

<**State**> Victoria

General

<**Year begun operation**> 1930

<**Active/inactive**> Active

<**Full surface area (ha)**> 500 ha

<**Volume capacity (ML)**> 28,770 ML

<**Full surface level (m AHD)**> < 60 m AHD (Swan Hill 1:100,000 topographic map)

<**Groundwater level (m AHD)**> 64 m AHD

<**Groundwater seepage/discharge**> Discharge

<**Average annual evaporation**> Inflow/evaporation < 0.2; 1400 mm/yr (Bromfield, 1953)

<**Volume disposed annually (ML/yr)**> 1200 ML/yr

<**Salinity of water disposed (EC)**> 1000 EC

<**Range of salinity in basin (EC)**> 23,000-216,000 EC

<**Sources of water to be disposed**> Woorinen Irrigation Area

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> Woorinen Murrawee
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Woorinen irrigation Area

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> Murrawee is composed of two or more basins that have coalesced into a larger basin. It is bounded on the eastern and northern side by a lunette and appears to have salt deposits along the edge of the basin indicating that it has received discharge in the past. There is a small inlet creek in the southeastern corner while the northwestern corner abuts a road. The topography of the area is controlled by Woorinen dunes and is presently being used for agricultural purposes.

<**Subsurface investigations at site**>

<**Structural setting**> The basin lies east of the Nyah Ridge and northeast of the Yarraby Ridges (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Yamba Formation (1-2 m), and is underlain by the Shepparton Formation (1-2 m), the Parilla Sand (60 m), and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Yamba Formation

<**Host lithofacies**> Clay, salt, and lunettes

<**Aquitard**> Shepparton Formation

<**Aquitard lithofacies**> Clays and silts

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

<Site Name> Woorinen Murrawee
<Synonyms>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 7.5 kilometres

<**Head between basin and river/tributary**>

<**Direction of groundwater flow in regional aquifer**> West away from the Murray River and towards Lake Tyrrell (O'Rourke, 1992)

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**>

<**Thickness of aquitard**> Shepparton Formation 1-2 metres

<**kv and kh of aquifer**>

<**EC of aquifer**> 10,000-35,000 mg/L TDS (RWC, 1993a)

<**Porosity of aquifer**>

<**Thickness of aquifer**> Parilla Sand: 60 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> The basin receives groundwater discharge from the Parilla Sand due to the high potentiometric surface within the Parilla. The rate of discharge is controlled by the thickness of the Shepparton Formation aquitard and whether it has been partially or completely eroded from under the basin. This is presently unknown, but comparing the full level of the basin (~ 60.0 m AHD estimated) with the top of Parilla structure contours (60 m AHD) and the regional thickness of the Shepparton Formation (8-10 m), we can estimate that at most 1-2 metres of Shepparton remains (interpreted from Thorne, Hoxley, and Chaplin, 1990). The discharge into the basin should cause few problems because of the high rate of evaporation within the basin (7000 ML/yr) however continued discharge and disposal to the basin may act to raise the local watertable within the Shepparton Formation.

<**Hydraulic linkage to surface runoff**>

<Site Name> Woorinen Murrawee
<Synonyms>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus> Evaporation capacity 7000 ML (500 ha x 1400 mm/yr)

Interpretive 2

<Ranking of sustainability>

References Cited

Bromfield, W.E., 1953- Woorinen South Drainage., State River and Water Supply Commission, Unpublished report

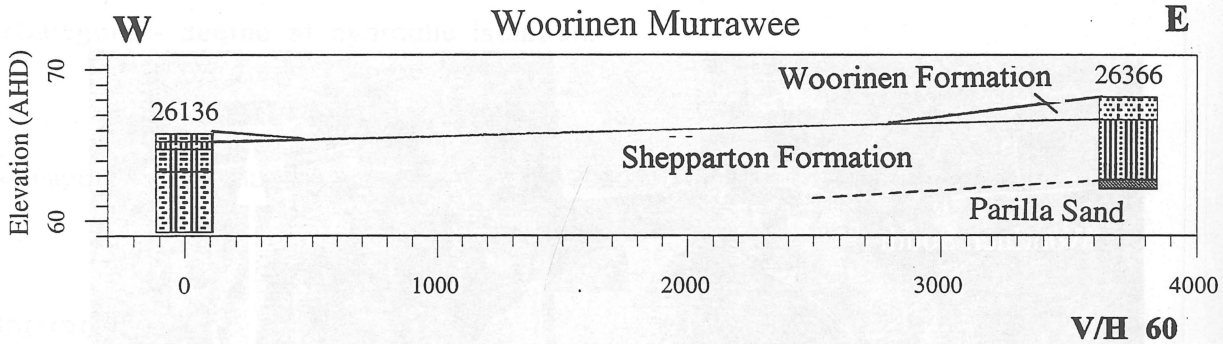
Lawrence, C.R., and Macumber, P.G., 1974- Swan Hill Geological Map (1:250,000 scale)., Geological Survey of Victoria

O'Rourke, M.E., et. al, Victorian Rural Water Commission, 1992- Swan Hill Hydrogeological Map (1:250,000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra Australia

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


Woorinen South
N
Woorinen Murrawee
0
1 km
2 km
(14/11/1964)


W
Woorinen Murrawee
E
Elevation (AHD)
70
60
26136
Woorinen Formation
26366
Shepparton Formation
Parilla Sand
0
1000
2000
3000
4000
V/H 60


Woorinen South
N
26366
26136
Woorinen Murrawee

<**Site Name**> Woorinen North
<**Synonyms**>

Spatial

<**Location description**> 7 kilometres NNW of Woorinen, Victoria and 9 kilometres SE of Nyah, Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Swan Hill

<**Location 1:100 000**> Nyah 7527

<**Zone**> 54

<**Coordinates easting (AMG)**> 721700

<**Coordinates northing (AMG)**> 6097700

<**State**> Victoria

General

<**Year begun operation**> 1930

<**Active/inactive**> Active

<**Full surface area (ha)**> 56 ha

<**Volume capacity (ML)**> 6222 ML

<**Full surface level (m AHD)**> 63.0 m AHD

<**Groundwater level (m AHD)**> 63.0 m AHD

<**Groundwater seepage/discharge**> Discharge

<**Average annual evaporation**> Inflow/evaporation = 0.3; 1400 mm/yr (Bromfield, 1953)

<**Volume disposed annually (ML/yr)**> 300 ML/yr

<**Salinity of water disposed (EC)**> 2550 EC

<**Range of salinity in basin (EC)**> 20,000-72,500 EC

<**Sources of water to be disposed**> Woorinen Irrigation Area

<**Terminal/throughflow basin**> Throughflow

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**> Evaporative capacity 2050 ML/yr throughflow to Murrawee

<Site Name> Woorinen North
<Synonyms>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Woorinen Irrigation Project

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is located in a depression (deflation basin?) within the surrounding Woorinen dunes. It is roughly oval in shape trending NE-SW and is connected to Woorinen Holloways by a channel in the northeastern corner of the basin.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located on the Nyah Ridge, northeast of the Yarraby Ridges (Parilla strandlines), and east of the Tyrrell Fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Shepparton Formation (3-5 m) and underlain by the Parilla Sand (60 m), and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Shepparton Formation

<**Host lithofacies**> Clays and silts

<**Aquitard**> Shepparton Formation

<**Aquitard lithofacies**> Clays and silts

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 3 kilometres

<**Head between basin and river/tributary**>

<**Direction of groundwater flow in regional aquifer**> West towards Lake Tyrrell (O'Rourke, 1992)

<Site Name> Woorinen North
<Synonyms>

<kv of artificial floor>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Shepparton Formation: 3-5 metres

<kv and kh of aquifer>

<EC of aquifer> 35,000-50,000 mg/L TDS (RWC, 1993a)

<Porosity of aquifer>

<Thickness of aquifer> Parilla Sand: 60 metres

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> The basin receives groundwater discharge from the Parilla Sand due to the high potentiometric surface within the Parilla. The rate of discharge is controlled by the thickness of the Shepparton Formation aquitard and whether it has been partially or completely eroded under the basin. This is presently unknown, but comparing the full level of the basin (~ 60.0 m AHD estimated) with the top of Parilla structure contours (60 m AHD) and the regional thickness of the Shepparton Formation (8-10 m), we can estimate that at most 3-5 metres of Shepparton remains (interpreted from Thorne, Hoxley, and Chaplin, 1990). The discharge into the basin should cause few problems because of the high rate of evaporation within the basin (784 ML/yr), however continued discharge and disposal to the basin may act to raise the local watertable within the Shepparton Formation.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<**Evaporation surplus**> 784 ML/yr (56 ha x 1400 mm/yr)

Interpretive 2

<**Ranking of sustainability**>

References Cited

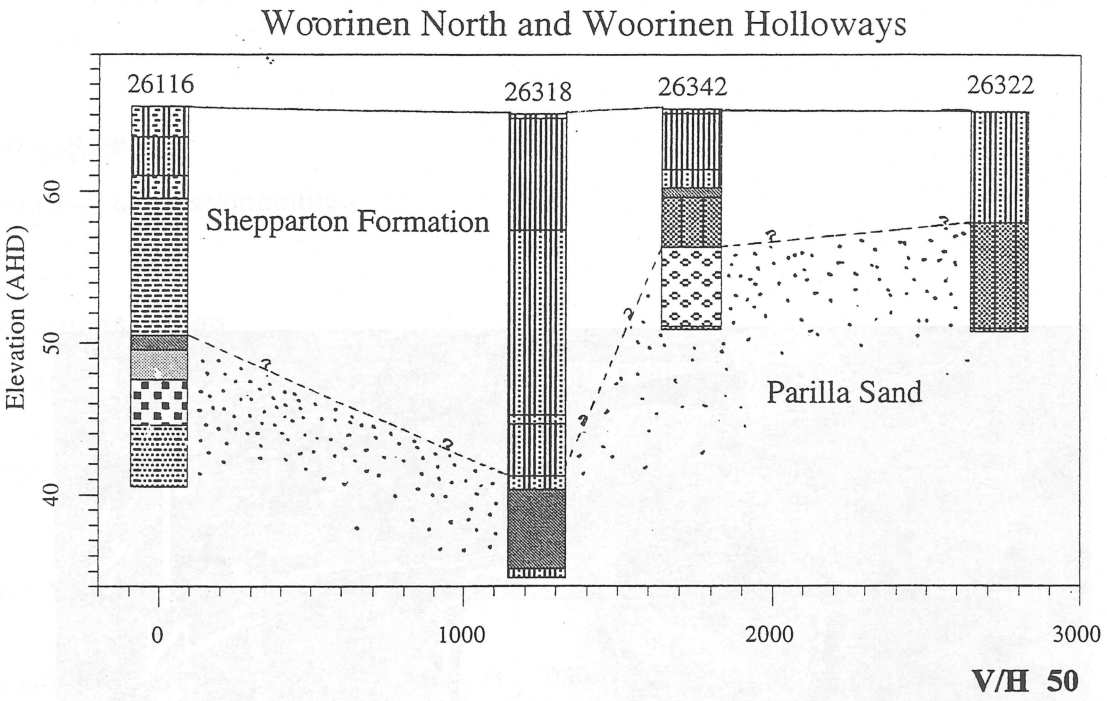
Bromfield, W.E., 1953- Woorinen South Drainage., State River and Water Supply Commission, Unpublished report

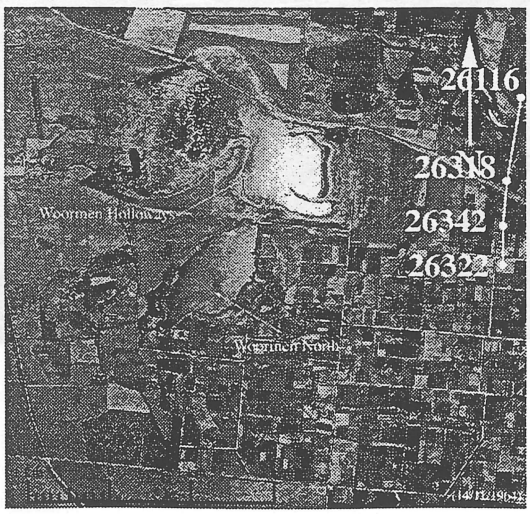
O'Rourke, M.E., et. al, Victorian Rural Water Commission, 1992- Swan Hill Hydrogeological Map (1:250,000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra Australia

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


N
Woorinen Holloways
Woorinen North
1 km
0
(14/11/1964)


Woorinen North and Woorinen Holloways
26116
26318
26342
26322
Shepparton Formation
Parilla Sand
Elevation (AHD)
60
50
40
0
1000
2000
3000
V/H 50


26116
26318
26342
26322
Woorinen North

<Site Name> Woorinen South
<Synonyms> Salt Lake Basin

Spatial

<**Location description**> 2 kilometres NE of Woorinen, Victoria and 15 kilometres SE of Nyah, Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Swan Hill

<**Location 1:100 000**> Nyah 7527

<**Zone**> 54

<**Coordinates easting (AMG)**> 725300

<**Coordinates northing (AMG)**> 6093500

<**State**> Victoria

General

<**Year begun operation**> 1930

<**Active/inactive**> Active

<**Full surface area (ha)**> 142 ha

<**Volume capacity (ML)**> 1800 ML

<**Full surface level (m AHD)**> 60.96 m AHD at 121 ha; 61.42 m AHD at 129.5 ha; 62.48 m AHD at 137.6 (Bromfield, 1953); ~63 m AHD at 142 ha

<**Groundwater level (m AHD)**> ~63 m AHD (O'Rourke, 1992)

<**Groundwater seepage/discharge**> Discharge

<**Average annual evaporation**> Inflow/evaporation < 0.2: Average 1400 mm/yr (Bromfield, 1953)

<**Volume disposed annually (ML/yr)**> 300 ML/yr

<**Salinity of water disposed (EC)**> 750 EC

<**Range of salinity in basin (EC)**> 51,300-109,000 EC

<**Sources of water to be disposed**> Woorinen Irrigation Area

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

Engineering/Admin

<**Public or private operation**> Public

<**Agency responsible**> Rural Water Corporation

<**Project name**> Woorinen Irrigation Area

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> Woorinen South is located in a deflation basin surrounded by Woorinen Formation dunes near the edge of the Shepparton Formation-Parilla Sand contact. The deflation appears to be on the order of 5-10 metres and has formed a lunette on the lake's eastern boundary. The land around the basin is currently being used for agriculture while cleared mallee lies immediately to the south.

<**Subsurface investigations at site**>

<**Structural setting**> The basin lies east of the Nyah Ridge and northeast of the Yarraby Ridges (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by Shepparton Formation (possibly Yamba Formation also) (1-2 m), and is underlain by the Parilla Sand (60 m), and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Shepparton Formation

<**Host lithofacies**> Clays and silts

<**Aquitard**> Shepparton Formation

<**Aquitard lithofacies**> Clays and silts

<**Aquifer**> Parilla Sand

<**Aquifer lithofacies**> Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 5 kilometres

<**Head between basin and river/tributary**>

<**Direction of groundwater flow in regional aquifer**> West away from the Murray River and towards Lake Tyrrell (O'Rourke, 1992)

<**kv of artificial floor**>

<**kv and kh of host**>

<**kv and kh of aquitard**>

<**Thickness of aquitard**> Shepparton Formation 1-2 metres

<**kv and kh of aquifer**>

<**EC of aquifer**> 35,000-50,000 mg/L TDS (RWC, 1993a)

<**Porosity of aquifer**>

<**Thickness of aquifer**> Parilla Sand: 60 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> The basin receives groundwater discharge from the Parilla Sand due to the high potentiometric surface within the Parilla. The rate of discharge is controlled by the thickness of the Shepparton Formation aquitard and whether it has been partially or completely eroded under the basin. This is presently unknown, but comparing the full level of the basin (~ 63.0 m AHD estimated) with the top of Parilla structure contours (60 m AHD) and the regional thickness of the Shepparton Formation (8-10 m), we can estimate that at most 1-2 metres of Shepparton remains (interpreted from Thorne, Hoxley, and Chaplin, 1990). The discharge into the basin should cause few problems because of the high rate of evaporation within the basin (1980 ML/yr), however continued discharge and disposal to the basin may act to raise the local watertable within the Shepparton Formation.

<**Hydraulic linkage to surface runoff**>

<**Category - hydraulic stability**>

<**Category - degree of hydraulic isolation**>

<**Evaporation surplus**> Evaporation capacity 1980 ML (1400 mm/yr x 142 ha)

Interpretive 2

<**Ranking of sustainability**>

References Cited

Bromfield, W.E., 1953- Woorinen South Drainage., State River and Water Supply Commission, Unpublished report

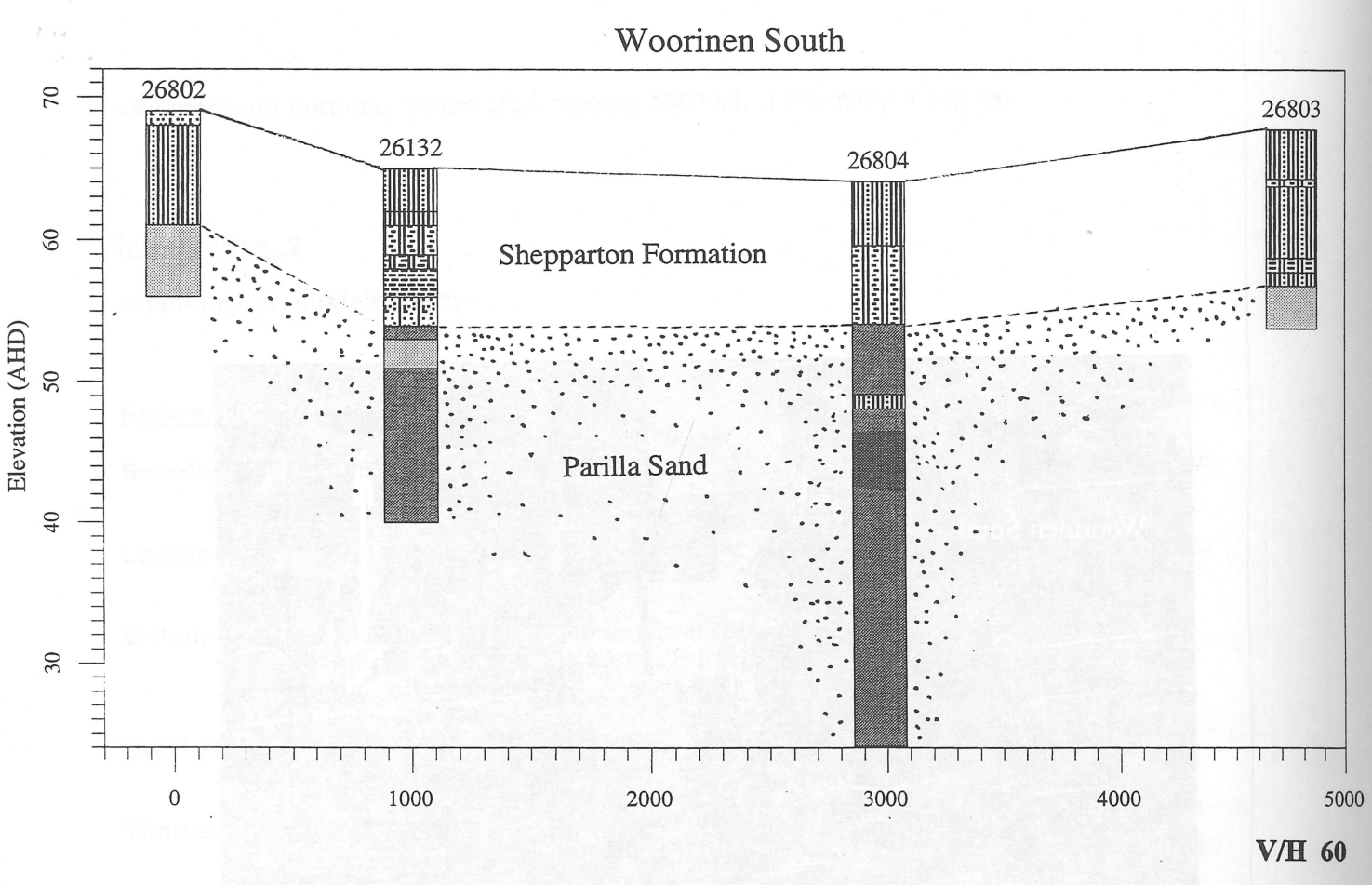
Lawrence, C.R., and Macumber, P.G., 1974- Swan Hill Geological Map (1:250,000 scale)., Geological Survey of Victoria

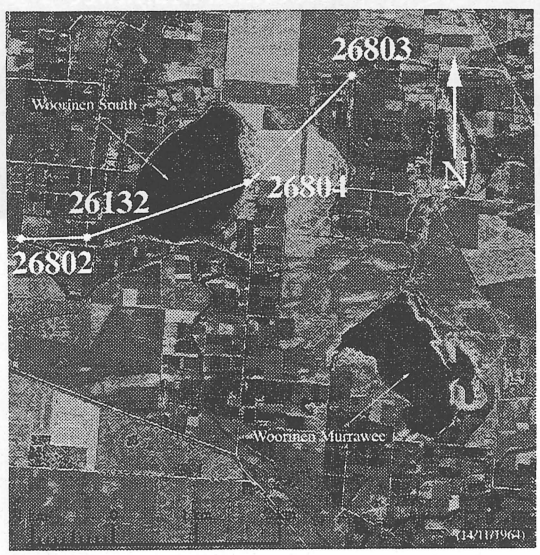
O'Rourke, M.E., et. al, Victorian Rural Water Commission, 1992- Swan Hill Hydrogeological Map (1:250,000 scale)., Bureau of Mineral Resources, Geology and Geophysics, Canberra Australia

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


Woorinen South
N
Woorinen Murrawee
(14/11/1964)


Woorinen South
26802
26132
26804
26803
Shepparton Formation
Parilla Sand
Elevation (AHD)
70
60
50
40
30
0
1000
2000
3000
4000
5000
V/H 60


26803
Woorinen South
N
26804
26132
26802
Woorinen Murrawee

<**Site Name**> Wren's Swamp
<**Synonyms**> Merbein 2

Spatial

<**Location description**> 8 kilometres SSW of Merbein, Victoria and 17 kilometres NW of Red Cliffs, Victoria

<**Located in Murray Trench**> No

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 595500

<**Coordinates northing (AMG)**> 6211300

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 13 ha

<**Volume capacity (ML)**> 40.5 ML

<**Full surface level (m AHD)**> 39.9 m AHD

<**Groundwater level (m AHD)**> 39.5 m AHD

<**Groundwater seepage/discharge**> Discharge?

<**Average annual evaporation**> Inflow/evaporation = 0.7

<**Volume disposed annually (ML/yr)**> 110 ML/yr

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**> Dry

<**Sources of water to be disposed**>

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

Engineering/Admin

<**Public or private operation**> Public

<Site Name> Wren's Swamp
<Synonyms> Merbein 2

<Agency responsible> Rural Water Commission

<Project name> Wren's Swamp

<Natural, modified natural or constructed> Natural

<Modification type and degree> None

Geological

<Site description and Geomorphology> The basin has deflated through the uneven surface of Blanchetown Clay and Woorinen Formation dunes so that it sits directly on the Parilla Sand. It is surrounded by cleared and uncleared mallee and appears to continue to receive discharge.

<Subsurface investigations at site>

<Structural setting> The basin is on the Merbein Ridge, northwest of the Danyo Fault, northeast of the Wargan Fault, and SSE of the Yelta Fault (Thorne, Hoxley, and Chaplin, 1990).

<Stratigraphic setting> The basin is floored by the Parilla Sand (although it is surrounded by Blanchetown Clay and a thin veneer of Woorinen Formation), and is underlain by the Bookpurnong Beds, the Murray Group, and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<Host formation> Upper Parilla Sand

<Host lithofacies> Pisolitic ferruginous duricrust and/or clayey sand

<Aquitard> Upper Parilla Sand

<Aquitard lithofacies> Pisolitic ferruginous duricrust and/or clayey sand

<Aquifer> Parilla Sand

<Aquifer lithofacies> Fine to medium sand

<Comments>

Summary of Hydrodynamics

<Distance to Murray or tributary> 9 kilometres

<Head between basin and river/tributary>

<Direction of groundwater flow in regional aquifer> Southwest away from the Murray River (RWC, 1991)

<kv of artificial floor>

<**Site Name**> Wren's Swamp
<**Synonyms**> Merbein 2

<**kv and kh of host**>

<**kv and kh of aquitard**>

<**Thickness of aquitard**> Upper Parilla Sand: 5-7 metres

<**kv and kh of aquifer**> Parilla Sand: Kh = 1.6 to 58 m/day (Duncan and Linke, 1992)

<**EC of aquifer**> > 50,000 mg/L TDS

<**Porosity of aquifer**>

<**Thickness of aquifer**> Parilla Sand: 30 metres

<**kv and kh of alluvial aquifer**>

<**Pre-existing potentiometric surface**>

Interpretive 1

<**Hydraulic linkage to regional aquifer**> Wrens Swamp probably receives discharge from either the Parilla Sand, the perched aquifer (in the Woorinen Formation) or a combination of the two. First, the basin is located in a deflation hollow that indicates long-term discharge to the area from the Parilla Sand during periods of higher groundwater. Second, the current level of groundwater in both the Parilla Sand and the perched aquifer is very high (due to accession of irrigation water beneath the Mildura-Merbein area) with the potentiometric head in the Parilla as high as the full level in the basin. Lastly, discharge to the basin is through the Upper Parilla Sand aquitard for the Parilla Sand and along the margins of the basin for the perched aquifer allowing easy access to the basin for the groundwater. It is difficult to determine which of the aquifers discharges to the basin, most likely they both do because of the high levels in both and the lack of a barrier to flow into the basin. The amount of discharge however is unknown because the basin is dry which indicates the discharge is less than the evaporation surplus (140 ML/yr).

<**Hydraulic linkage to surface runoff**>

<**Category - hydraulic stability**>

<**Category - degree of hydraulic isolation**>

<**Evaporation surplus**> Inflow 110 ML/yr and evaporation capacity 257 ML/yr (1980 mm/yr x 13 ha) which means the surplus is 147 ML/yr

Interpretive 2

<**Ranking of sustainability**>

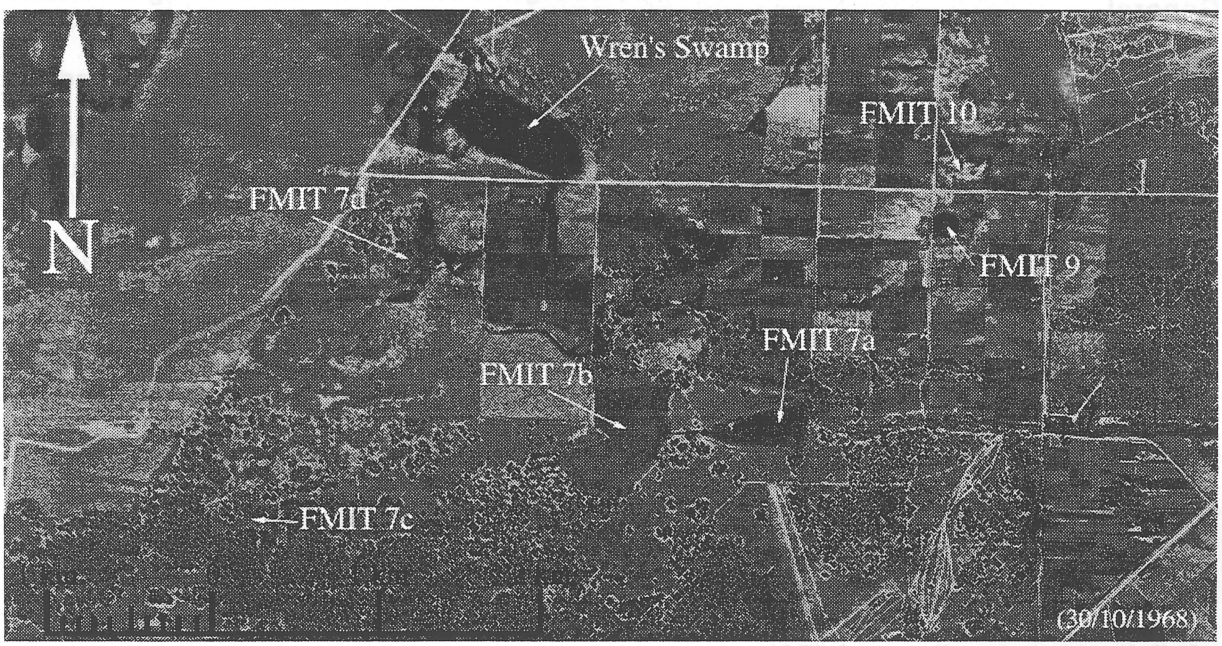
References Cited

Duncan, B., and Linke, G., 1992- An assessment of seepage from the Wargan Basins., Rural Water Corporation, Unpublished report 1991/23

Hoxley, G., 1991- Hydrogeological summary of wetland areas in the Sunraysia Salinity Management Plan Area., Rural Water Corporation, Groundwater Section, Technical note 1

Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.


Wren's Swamp
FMIT 10
FMIT 7d
N
FMIT 9
FMIT 7a
FMIT 7b
FMIT 7c
(30/10/1968)

<Site Name> Yatpool
<Synonyms>

Spatial

<**Location description**> 5 kilometres NNE of Carwarp, Victoria and 10 kilometres SSE of Red Cliffs, Victoria

<**Located in Murray Trench**> Yes

<**Location 1:250 000**> Mildura

<**Location 1:100 000**> Mildura 7329

<**Zone**> 54

<**Coordinates easting (AMG)**> 613000

<**Coordinates northing (AMG)**> 6192000

<**State**> Victoria

General

<**Year begun operation**>

<**Active/inactive**> Active

<**Full surface area (ha)**> 1000 ha (???, 1975)

<**Volume capacity (ML)**>

<**Full surface level (m AHD)**> ~35 m AHD estimate basin is usually dry

<**Groundwater level (m AHD)**> Channel Sand: 36.8 m AHD, Parilla Sand:36.8 m AHD (Thorne, Hoxley, and Chaplin, 1990)

<**Groundwater seepage/discharge**> Discharge

<**Average annual evaporation**> 1980 mm/yr Class A pan Red Cliffs (for 1000 ha equals 19,800 ML/yr)

<**Volume disposed annually (ML/yr)**>

<**Salinity of water disposed (EC)**>

<**Range of salinity in basin (EC)**> 5520 EC

<**Sources of water to be disposed**> Groundwater and tile drains

<**Terminal/throughflow basin**> Terminal

<**Range of elevation of lake surface with disposal**>

<**Lining/treatment of base**> None

<**Review of environmental impacts**>

<Site Name> Yatpool
<Synonyms>

Engineering/Admin

<**Public or private operation**>Private

<**Agency responsible**> Landholders

<**Project name**> Yatpool Basin

<**Natural, modified natural or constructed**> Natural

<**Modification type and degree**> None

Geological

<**Site description and Geomorphology**> The basin is located within the Murray Trench and is a regional discharge site. It has deflated through the Rufus Terrace and has formed a lunette on its eastern margin. The basin floor is free of vegetation, covered in salt deposits and has remnant pedestals of Coonambidgal Formation?.

<**Subsurface investigations at site**>

<**Structural setting**> The basin is located in the Karadoc trough, northeast of the Wargan Fault, although part of the basin lies on the downthrown side of the fault (Thorne, Hoxley, and Chaplin, 1990).

<**Stratigraphic setting**> The basin is floored by the Yamba Formation (2-3 m), and is underlain by the Coonambidgal Formation? (0-2 m), the Channel Sand (0-3 m), the Blanchetown Clay (0-20 m), the Parilla Sand (80 m), the Bookpurnong beds, the Murray Group and the Renmark Group (Geology interpreted from Thorne, Hoxley, and Chaplin, 1990).

<**Host formation**> Yamba Formation

<**Host lithofacies**> Clay, salt, and gypsum

<**Aquitard**> Blanchetown Clay and Upper Parilla Sand

<**Aquitard lithofacies**> Blanchetown Clay: Clay and clayey silt; Upper Parilla Sand: Clayey sand and/or pisolitic, ferruginous duricrust.

<**Aquifer**> Parilla Sand and Channel Sand on basin margins

<**Aquifer lithofacies**> Parilla Sand and Channel Sand: Fine to medium sand

<**Comments**>

Summary of Hydrodynamics

<**Distance to Murray or tributary**> 7 kilometres

<**Head between basin and river/tributary**>

<**Direction of groundwater flow in regional aquifer**> Northwest into Yatpool Basin

<**kv of artificial floor**>

<Site Name> Yatpool
<Synonyms>

<kv and kh of host>

<kv and kh of aquitard>

<Thickness of aquitard> Blanchetown Clay: 0-20 metres; Upper Parilla Sand: 3-4 metres

<kv and kh of aquifer> Parilla Sand: Kh = 1 m/day; Channel Sand: Kh = 10-40 m/day (Linke, 1990b)

<EC of aquifer> > 50,000 mg/L TDS (RWC, 1993); Parilla Sand: 40,000-50,000 EC; Channel Sand: 100,000 EC (Thorne, Hoxley, and Chaplin, 1990)

<Porosity of aquifer> Channel Sand: 20% (Linke, 1990b)

<Thickness of aquifer> Parilla Sand: 80 metres; Channel Sand: Absent in middle of basement (except for pedestals), but around the edge is 6-10 metres.

<kv and kh of alluvial aquifer>

<Pre-existing potentiometric surface>

Interpretive 1

<Hydraulic linkage to regional aquifer> Yatpool Basin is complex structurally and stratigraphically. It lies on the edge of the Murray Trench and receives discharge from the Channel Sand aquifer. Over the years, the basin has deflated through the Rufus Formation and the Channel Sand until it has intercepted the Upper Parilla Sand and/or Blanchetown Clay. However, the Channel Sand still exists on the margins of the basin and in isolated pedestals. The Blanchetown Clay is under the northwestern portion of the basin getting thicker towards Karadoc Trough while the southeastern portion of the basin is underlain by the Upper Parilla Sand.

The basin intercepts about 150 ML/yr of groundwater from the Channel Sand at an average salinity of 30,000 mg/L TDS (Linke, 1993). The groundwater is concentrated in the basin because of the large evaporation surplus (>19,500 ML/yr) and is evaporated. There may be a possibility of the concentrated groundwater entering the Parilla Sand if there is a breach in the Upper Parilla Sand aquitard, but because the hydraulic head of the Parilla Sand is near or above the level of the basin it should pose no problem.

<Hydraulic linkage to surface runoff>

<Category - hydraulic stability>

<Category - degree of hydraulic isolation>

<Evaporation surplus> (19,800 ML/yr Evaporation)-(150 ML/yr Input)

<Site Name> Yatpool
<Synonyms>

Interpretive 2

<Ranking of sustainability>

References Cited

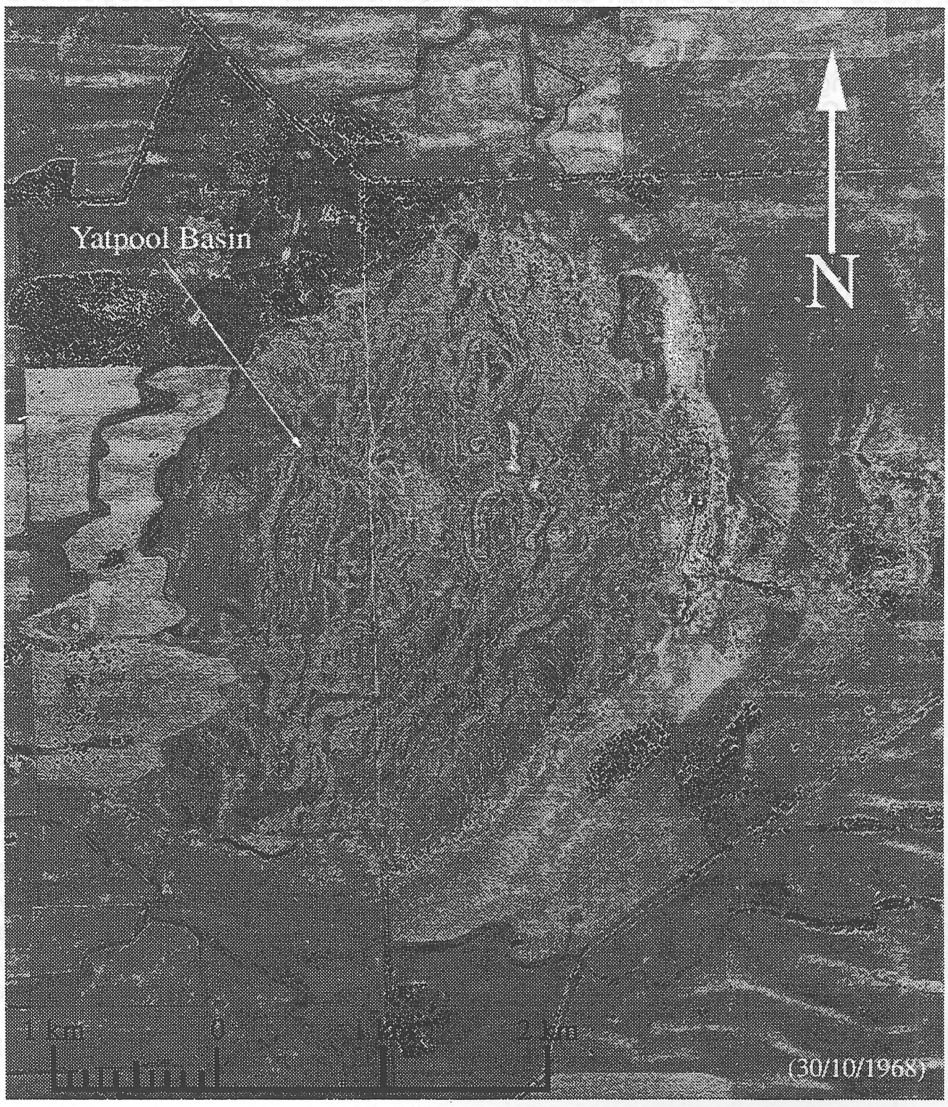
Linke, G.K., 1990b- Nangiloc-Colignan Salinity Management Plan: Hydrogeological characteristics technical report. Rural Water Commission of Victoria, Report. 1989/41

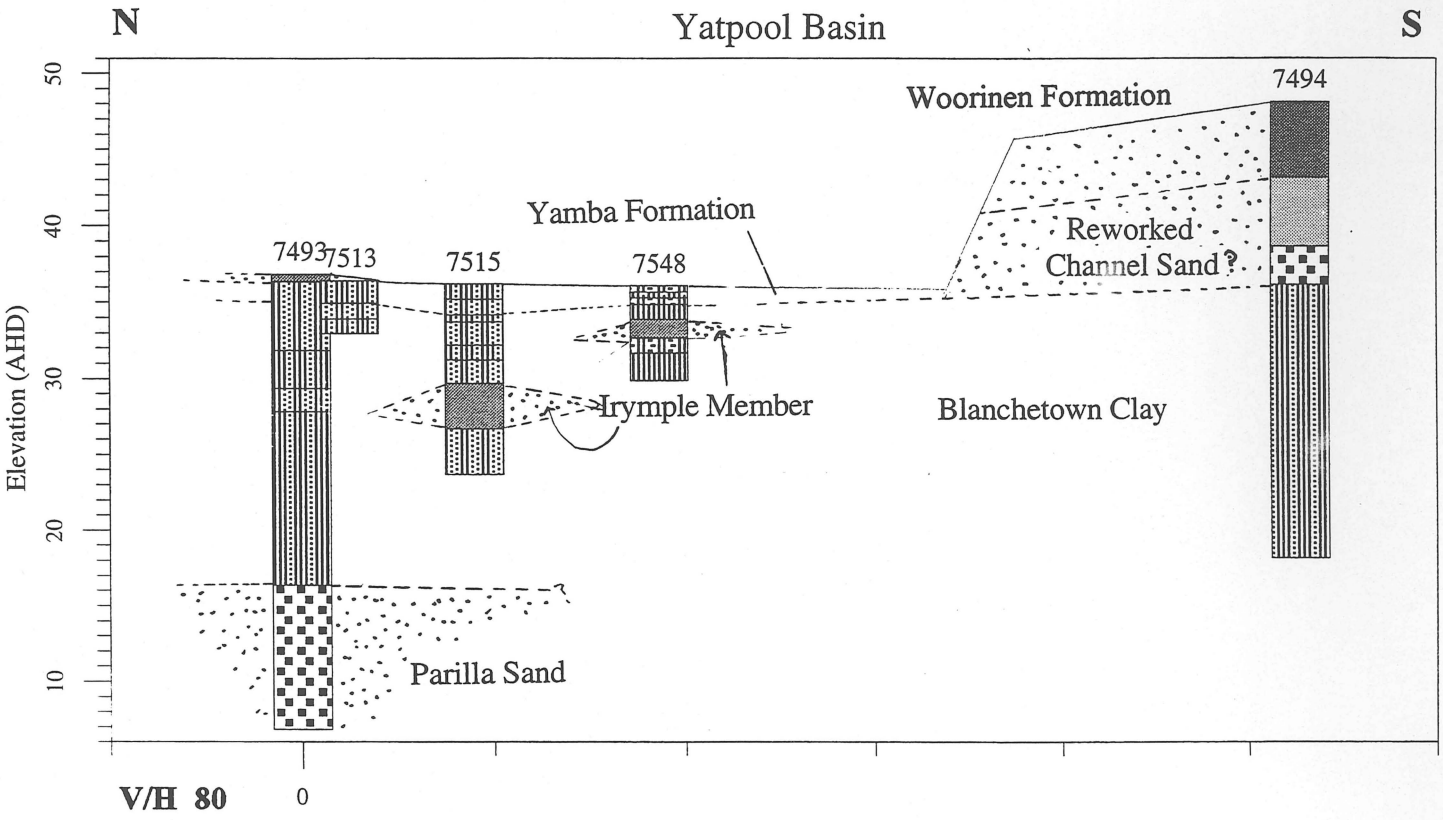
Linke, G., 1993- Nangiloc Colignan SMP - Drainage disposal to Karadoc Swamp - CMS Comps., Rural Water Corporation, Unpublished working file No. 93/01895

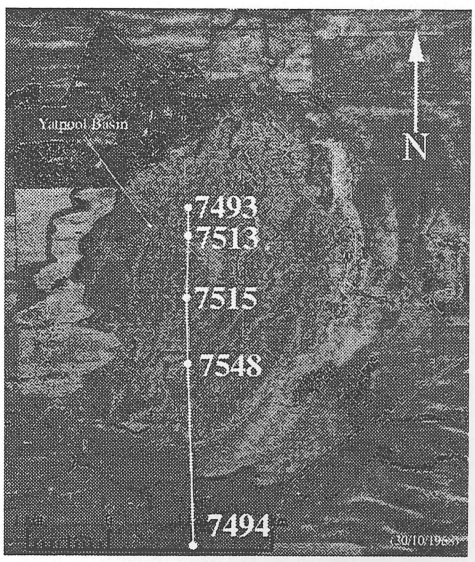
Rural Water Commission, 1993a- Evaporation disposal basins data summary, Draft report, Unpublished, 211 pp.

Rural Water Commission, 1991- Mildura Hydrogeological Map (1:250 000 scale), Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

Thorne, R., Hoxley, G., and Chaplin, H., 1990- Nyah to the South Australian border hydrogeological project volumes 1 and 2, Investigations branch report 1988/5, Rural Water Commission of Victoria, v 1 (text) 372 pp., v 2 (maps) 63 pp.


Yatpool Basin
N
1 km
0
1
2
(30/10/1968)


N
Yatpool Basin
S
Elevation (AHD)
50
40
30
20
10
7493
7513
7515
7548
7494
Woorinen Formation
Yamba Formation
Reworked
Channel Sand ?
Irymple Member
Blanchetown Clay
Parilla Sand
V/H 80
0


Yatpool Basin
N
7493
7513
7515
7548
7494