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LANDSAT 2 PROJECT NO. 2896D

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QUARTERLY PROGRESS REPORT

CR-146517

I. INTRODUCTION

Title: Water Utilisation, Evapotranspiration and Soil  
Moisture Monitoring in the South East Region of  
South Australia.

Assigned Investigation No.: 2896D

Authors' Names: Keith R. McCloy, South Australian  
Institute of Technology.

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DCAF# 00321810  
B R S A R

Reporting Date: 2.2.76 (FTD + 4 months)

Note: Work on Project 2896D has reached the stage where  
progress to date can be reported under the first  
three section headings only of the recommended  
nine headings, viz Introduction, Techniques and  
Accomplishments. It is anticipated that subsequent  
reports will contain contributions under progress-  
ively more section headings as the investigation  
advances.

N76-21627

Unclas  
00234

G3/43

(76-10234) WATER UTILISATION,  
EVAPOTRANSPIRATION AND SOIL MOISTURE  
MONITORING IN THE SOUTHEAST REGION OF SOUTH  
AUSTRALIA Quarterly Progress Report (Bureau  
of Mineral Resources) 4 p HC \$3.50 CSCL 08M

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GPO: 1976-1-100-100

## II TECHNIQUES

### 1. Material Received, up to 1.31.76

Bulk Black and White 70 mm Negative Transparencies of Bands 4,5,6 and 7 of the following frames:-

|      |   |       |
|------|---|-------|
| 2089 | - | 23374 |
| 2107 | - | 23373 |
| 2143 | - | 23372 |
| 2144 | - | 23430 |
| 2161 | - | 23381 |
| 2162 | - | 23435 |
| 2163 | - | 23485 |
| 2198 | - | 23424 |
| 2198 | - | 23431 |
| 2234 | - | 23424 |
| 2252 | - | 23414 |

### 2. Material Ordered, excluding photographic standing order, as at 1.31.76:-

CCT of frame 2198 - 23424.

### 3. Status of Project

Within an area of known vegetation cover, both the percentage area of vegetation cover and the condition of individual plants is related to the soil moisture deficit for that area and affects the evapo-transpiration occurring in the area. Also, different types of land cover will make different demands on soil moisture and exhibit different evapo-transpiration characteristics. Thus information on land cover types and condition may be an essential parameter in the final mathematical modelling. To assess this likelihood, co-investigators have commenced studies on classifying the land cover, based on LANDSAT imagery. Classification of land cover will need to be in terms of plant or crop type and conditions, and will need to have much better resolution than current published work in this field. Investigator K.R. McCloy believes that this is possible if there is a thorough understanding of how the different surfaces are recorded by LANDSAT, and how physical changes in the surface modify the signature of that surface.

The necessary field information will be collected by:-

- (a) Aerial photography at 1:30,000 on colour, false colour and panchromatic film of selected sample areas depicted on the attached map, at two dates and funded by the E. & W.S. Department. The first coverage was flown in November 1975, being postponed from proposed September dates by adverse weather conditions.

- (b) Field surveys associated with above sample areas by officers of Department of Agriculture and Fisheries and E. & W.S. Department. This work commenced in September 1975.
- (c) Other existing and projected land use surveys within the region, notably of Padthaway (vicinity GR 3547) and Coonawarra (vicinity GR 3840).

McCloy has developed the necessary computer programmes to utilise the digital data. Existing programmes can:

- (a) Select and extract sample areas, calibrate scan lines using LANDSAT interval calibration data and print out.
- (b) Conduct statistical analysis of sub areas considered to be of a uniform land cover type, including goodness of fit, means, covariance matrix, eigenvectors and eigenvalues, plot of histograms and Swain Fu distance from other sub area classes.
- (c) Transform the data by principal components, cluster the data in each combination of two dimensions and produce contour plots of these combinations.
- (d) Classify an area by either discriminant analysis, four dimensional spheroids derived from clustering or based on mathematical modelling as will be described below for water surfaces.

Whilst an automated clustering algorithm for classification is essential, McCloy does not believe that it is precise enough on its own. Greater priority is therefore being given to understanding the surface signatures as a basis of the other classification techniques.

### III ACCOMPLISHMENTS

A total of fifteen lake surfaces have been analysed and it was found that they could be grouped into four or five broad classes. The fourth and/or fifth class contains areas of swamp or water weeds and analysis of them is dependent upon using the aerial photography mentioned in para. 3a. The other three broad classes are:-

- (a) Ocean type, with signatures similar to the ocean, but statistically greater separability is achievable.
- (b) Lake Bonney, Again statistically separable into smaller classes which yield a distinct pattern across the lake.

(c) Class of Inland Lakes, The spectral signatures of the lakes exhibit a strong regression relationship between the various lakes. It is suspected that the regression is related to the turbidity levels in the lakes. Field data is being collected to determine the reason for the regression and once it has been isolated then classification will be possible in terms of that physical parameter.

Detailed study of land cover types will need to wait until field information is available from the sources mentioned in paragraph 3, and compatible digital data is available. The first of these is on order as per paragraph 2.

Work by investigator McCloy in forming histograms of the data for whole strips in the frame indicates that a significant see-saw effect exists between adjacent values in bands 4,5, and 6. It is believed that this is introduced during the calibration stage. This will have some effect on the distribution of the data within areas of uniform surfaces. To overcome this flow, McCloy has modified the data such that values

0 and 1 become 0  
2 and 3 " 1

126 and 127 become 63 on these three bands. It is felt that any loss of information by this division is less than the aberrations inbuilt into the expanded form. However comments on the above paragraph would be appreciated.

A recognition of the importance of public awareness and support for this research has prompted the investigators to conduct a public display of the work done to date. This display will be open in Adelaide and in the South East from 1st March, 1976. Mr. McCloy is concerned at the effects of adverse weather conditions on the project. This has been the subject of separate discussion concerning the photographic imagery. However up to September 1975, only one frame, 2198 - 23424 of 6 August 1975 is sufficiently clear to justify ordering a magnetic tape record. This will make digital analysis, particularly with regard to temporal change, difficult within the time period. A review will be conducted once the successful summer coverage is known, and an extension of time may be requested.