AERIAL PHOTOGRAPHY OF RIVERS — BLACK AND WHITE INFRA-RED FILM (NOTE)

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The ability to record accurately the changes of a river plan form with time is of the utmost importance where the design of river control works is contemplated, since, until the behaviour of a river is fully known, its response to control measures cannot be predicted. This is particularly important in New Zealand where many of our most troublesome rivers are braided, and such streams are notoriously difficult to control. It is unfortunate, therefore, that it is also more difficult to record the channel pattern of a braided river than a single-channel stream by aerial photography. The main difficulty lies in interpreting the photographic print to decide what is water and what is not. When ordinary (panchromatic) black and white film is used, this decision may be difficult because:

(i) the background tones of a braided river bed may be very varied, ranging from almost white (dry silt or shingle) to very dark (vegetation);
(ii) the tone of the water may also vary from very light (where large suspended load concentrations are present, particularly with glacial silt) to very dark (clear water); and
(iii) parts of the flow in a braided channel may be very shallow causing further variation in tone on the photograph.

In a series of aerial surveys conducted as part of a continuing study of braided stream patterns by the Department of Agricultural Engineering, Lincoln College, these difficulties have been successfully overcome by the use of black and white infra-red sensitive (BWIR) film with a red (Nikon L39) filter. Water effectively absorbs infra-red radiation and consequently stream patterns register as dense black tones when printed. The accompanying photographs of a section of the Waimakariri River (Fig. 1) (taken with a hand-held 35 mm Nikkormat camera from an altitude of 3000 m) show the very significant increase in ease and reliability of interpretation using BWIR film compared to panchromatic film.

TECHNIQUE

The film used has been Kodak High Speed infra-red (HIE 135-20) at present available (in N.Z.) only in 20 exposure cassettes. This film is very sensitive to heat, and must be stored in refrigerated conditions, and in addition must be loaded and unloaded in TOTAL darkness. These

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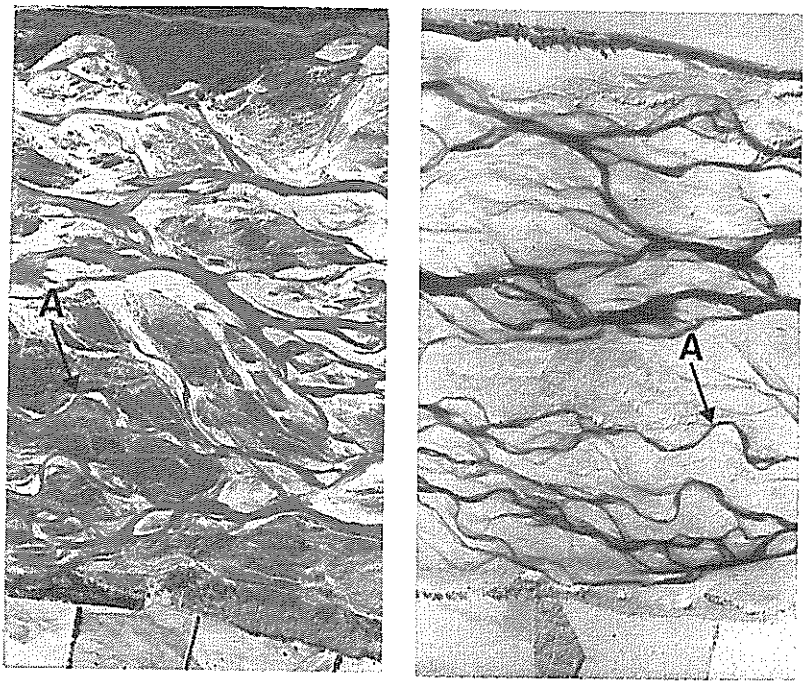

FIG. 1—Aerial photographs of the Waimakariri River taken with a hand-held 35 mm camera from 3000 m (Cessna 172 aircraft). Position A is shown on each photograph to aid comparison of channel features: (i) BWIR with Nikon L39 Red Filter; (ii) PAN with UV filter.

constraints mean that loading film in a small aircraft is impracticable, and so where a long series of photos is required (as for instance in surveying the Plains section of the Rakaia and Waimakariri Rivers) up to four pre-loaded cameras are required.

For the best results with BWIR film cloudless sky is required. Some degree of high cloud is acceptable; while it reduces the detail detectable in land features, water bodies still stand out clearly. Although a high sun position decreases the possibility of shadow problems, it has been found that a loss of tone density in water bodies can result from reflection from the water surface. In the wide riverbeds of interest to this project no shadow problems have been encountered using lower sun positions, and detail of land features is often improved by the presence of shadows.

BWIR has the advantage over colour infra-red film (which also accentuates the contrast of water bodies) that the exposure latitude is wide and errors of exposure can often be corrected in printing. The film can be processed using chemicals which are suitable for normal panchromatic film.

COSTS

BWIR film is comparable in cost to normal panchromatic film, and much cheaper than colour film. Printing costs and techniques are identical to those of normal black and white film, and, for producing printings for detailed study or for mosaics, much cheaper than colour film.

The total cost of obtaining a mosaic of a 80 km length of river was approximately $100 inclusive of printing.

CONCLUSIONS

The use of black and white infra-red sensitive film in recording the channel patterns of braided rivers offers significant advantages over panchromatic and colour infra-red film. Some care is needed in handling the film, and if it were to become available in larger cassettes or 15 m cans its use would be much more convenient.