

HYDROLOGICAL IMPRESSIONS FROM A VISIT TO THE U.S.

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In August and September I was fortunate enough to visit the United States on a five week visit which was divided between the General Assembly of the International Association of Scientific Hydrology at Berkeley, California, and a tour of agencies in the western States to see modern activity in basic hydrology and related water technology. Another main objective was to learn of the facilities existing in the U.S. for specialist education and job training.

Californian sunshine and the shining buildings of San Francisco were a welcome transformation from the tail-end of a Wellington winter and it took very little time to get settled in the University of California at Berkeley over the bay for two weeks of technical discussions. This was a time to learn how hydrology looks round the world; to make friends with many who have been respected names on publications; to gather background on American work; and to get current work in New Zealand in perspective.

It was a busy time but on the whole there were not too many surprises. It seems that efforts in New Zealand to understand and keep abreast of modern methods have been a considerable success as amongst the leading authorities N.Z. hydrological work is well known and comes in for favourable comment. There seemed to be justification for thinking that this notice was due solely to technical quality but I also noticed that most people had found that our foolscap-sized publications attract notice as they project from normal bookshelves and the scenic photographs reproduced on the covers are worth a second look.

Technically the Assembly with usually about three concurrent sessions and half the papers delivered in French was rather more than one man could reasonably absorb. However, new developments of high quality were not overlooked because they were soon a matter for gossip. Full publications will also be available by December. The subjects dealt with where we had most to learn seemed to me to be: automation, groundwater hydrology, and hydro-meteorology.

The International Hydrological Decade will obviously be a focal point of considerable value in the next ten years. This project is enthusiastically supported and one can readily sense an arousing of interest in raising standards of work.

On tour in the United States one realises that although

water technology is well known to be very advanced it still takes personal experience to bring home the immense scope of the work.

California, Arizona, Nevada, and Utah are four States which are good examples of the reason why. Although the United States are sometimes described as a water-rich nation this water is not very evenly distributed either in space or in time, and the population for some strange reason often concentrates most in those regions where the scarcity is most marked. California, for example, has just taken from New York the title of the most populous State in the Union but in almost the whole of the State there is no rainfall throughout the long hot summer, and the new State Water Plan required the spending of \$1,750,000,000 in the next ten years to bring water seven hundred miles to the thirsty south. Figures are inadequate to describe an operation which, in equivalent, transports half the flow of the Waikato from beyond the North Cape to Wellington.

It takes more than a single agency to develop the skills whereby such large scale projects can be successfully planned, constructed and operated and the prime source of these skills are clearly specialist education and basic data.

A large country can arrange many specialist options at universities and this has been done over the years until there is now a rich variety of courses in hydraulic engineering, agricultural engineering hydrology, and groundwater hydrology, and other courses with what has been described as having a "water resources content". There also seems to be an astonishingly good partnership between campus and working organizations. I found several post-graduate students in full employment with field organisations and conversely a student project on campus financed by funds of a federal agency.

The source of basic data is the Water Resources Division of the U.S. Geological Survey. The Survey's routine operations were kept fairly separate in the three major branches; surface water, ground-water, and quality of water. Outstanding impressions of the U.S.G.S. were friendliness, enthusiasm for work, and eagerness to discuss points and exchange information. Equipment at gauging sites was simple and economical by our standards; concrete recorder houses have not been built for the last thirty years; cableways follow the original pattern and gauging equipment has changed little in a long time. Just the same there seemed to be plenty of new ideas; an acoustic meter which offers an integrated velocity measurement by the timing of the travel of sound waves in stream-flow; and many developments following the introduction of computers.

On tour it was an enlightening experience to make personal contact with other agencies doing work which is comparable with our own requirements here in New Zealand or which produces new approaches to basic problems.

The Agricultural Research Service impressed with a concentration of specialists at each research centre. Hydrology, engineering, soils, and vegetation specialists were always working together as a team. Hydrological analyses are similar to the work done here on bench-mark catchments, and I also thought that data from stations such as Coshocton and Tucson could be used directly in New Zealand for the understanding and teaching of fundamentals.

Forest Service had specialties in snow studies and methods for assessing the erodibility of soils, and at San Dimas we were shown data of interest on the effects of revegetation after the disastrous fires of three years ago. Incidentally, the "bottomless bucket" approach was at odds with pressing demands in these dry areas for increases in the yield of water for surface supply.

In Sacramento where the trees are surely looked after by the spirits of Burke's Pass I was looked after by the State Department of Water Resources, and got some idea of the methods used to appraise, utilise and safeguard the water resources of California. This is a technical achievement of the first magnitude and it may encourage the girls in hydrology to know that hydrological work is directed by one of America's women engineers, Mrs Joyce Peters. I was able to see here also the Weather Bureau River Forecast Center; this center contained one of the Weather Search Radar sets capable of detecting precipitation within 250 miles of the center and sometimes but not always able to judge the intensity with an accuracy of around $\pm 20\%$.

These centers also have another main function of forecasting water availability in all river basins. This is done by combining the estimate of snow yield with yield from river basin storage plus normal expectations of precipitation. These data are published at the beginning of the irrigation season and are very important for planning the season's activities.

For an urgent problem in erosion control the San Gabriel mountains must have few equals. The Los Angeles County Flood Control District certainly will not be out of work for many years. The bill for removing debris from flood channels alone is \$500,000 each year. This particular problem has led to the introduction of a comprehensive scheme for installing dams solely for debris retention. These were simple and interesting structures made of concrete cribs with a rock-fill face and made a tidy and effective structure when built.

In a short trip much of interest had to be bypassed but it was possible to gain a reasonable picture of the important parts in a complex scene. We hope there will be other opportunities to maintain contact and certainly our library will be well stocked by exchanges of information with new-found friends in the Western States.