

POST-WAR MAPPING AND AERIAL PHOTOGRAPHY FOR NEVADA*

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EDITOR'S NOTE: In publishing this article, the American Society of Photogrammetry does not necessarily share the views expressed herein.

The Nevada program has aroused considerable interest in many of her neighbor states. It is hoped that by publishing this article, other states will submit their plans on post-war mapping to the American Society of Photogrammetry for possible publication in this journal. It is believed by so doing that mutual benefits will be derived by all.

ONE of the prime prerequisites for the orderly and efficient development of any area is the availability of adequate maps; and the lack of such maps has been seriously felt in Nevada for many years. For a long time this was chiefly the concern of local State and county agencies; but because of the vast public land areas in the State and the growing interest of the National government in conservation, a number of Federal departments have extended their activities into the State; and they too have felt this deficiency. The administration and regulation of the public lands require base maps upon which to detail vital information; and the planning of conservation, flood control, reclamation, highways, and other enterprises also depends upon similar maps.

Because there have been no over-all base maps which could be utilized, each map-using agency has been forced to become a map-making agency, preparing base maps to meet the demands of its particular field, but which probably did not meet the requirements of some other bureau operating in the same area. The minimum of adequate information available precluded accurate compilation, and often the expense incurred in office work to prepare a reasonably acceptable base from limited and widely separated control points resulted in expenditures approaching the cost of field and office work for a first-class planimetric map. The outcome of this condition has been the expenditure of many hundreds of thousands of dollars for duplicate and overlapping mapping of a character not at all suited to meet the requirements of a National mapping program, and in most instances not satisfactory to the agency preparing the maps because of the lack of adequate basic information. It is probable that sufficient funds have been spent in Nevada during the past ten years for mapping to have provided state-wide coverage by base maps qualified to meet the standards of any National program; and yet, the mapping in Nevada which can be safely said to meet such standards is limited to the comparatively few modern U.S.G.S. topographic sheets and a few aerial planimetric maps prepared by the Forest Service and the Grazing Service in cooperation with the State Highway Department. It must be emphasized that no criticism should be directed at the Federal and State agencies that have prepared base maps to meet their needs, but rather at a National policy which has permitted the complete mapping of the several states to lag to the extent that every map-using agency must prepare its own or go without.

That the conditions as outlined above are not confined to Nevada alone, but are nation-wide, is evidenced by action dating back to 1919 when the Federal Board of Maps and Surveys was created to coordinate mapping activities in the United States. In 1925 the Temple Act authorized the completion of the basic

topographic mapping in twenty years (and failed to provide the funds to carry it on). In March 1939, the Secretaries of War, Commerce, and the Interior, in a joint letter to the Senate, advocated a program to complete the mapping of the United States, for which little or no funds were provided. During the present war much has been accomplished in areas critical to the National defense; but in most states mapping activities have come to a complete halt.

Because it was felt that the period following the war might offer an opportunity for extensive mapping in Nevada, and in order that any such work might be programmed to meet the requirements of all concerned, a meeting was held in Reno on April 10, 1944, at which most of the map-using agencies were represented, for the purpose of discussing their requirements and drafting a policy for presentation to the proper State and Federal authorities, setting up a list of recommendations for their consideration and approval. This initial meeting resulted in the appointment of a subcommittee to gather data and prepare an outline for a second meeting; and, at this second meeting, held June 8, 1944, a tentative plan was approved by the local representatives and submitted to the various departments for comment and suggestions. This introductory statement and the following recommendations incorporate the suggested changes to the tentative plan, and are presented as a mapping plan for Nevada.

1. Provide for the early completion of the National Mapping Program along the general lines suggested in the joint letter to the Senate submitted by the Secretaries of War, Commerce, and the Interior in 1939, through setting up a program designed to meet a definite schedule. However, because mapping activities have lagged in most areas during the war, and because of the urgent need by numerous Federal and State agencies for complete map coverage for use both in postwar planning and action programs, it is recommended that the program outlined in the joint letter be accelerated. The initial bill setting up the program should provide for definite appropriations on a regular basis, so that the mapping agencies may know for several years in advance the funds available, and thus program their work in an orderly and efficient manner.

Most of the surplus military surveying and mapping instruments should be transferred to the established governmental mapping and surveying organizations at the close of the war, and the funds should be available and the work sufficiently outlined so that trained military personnel could be offered employment upon release from the Service.

It should be borne in mind that efficient mapping and control surveying cannot be accomplished by ordinary engineering personnel without extensive training and each branch of the military service has trained many mapping and surveying crews, especially in using aerial photographs. The training these men have received has been expensive and detailed, and yet the field for employment out of military service will be small indeed unless an expanded mapping program is carried out after the war. The country can render itself a service by taking advantage of the technical training it has paid for, and at the same time provide an opportunity for the returning soldier to use the knowledge he has acquired in military service to make his living in private life.

In order that full returns be realized from the training these men have received, it is imperative that a program which can utilize their services be prepared and ready for immediate execution, so that if any trained military personnel desires to engage in civilian mapping work at the close of the war, he may be offered employment. Otherwise, once he returns to other types of endeavor, it may be difficult to induce him to return to mapping work. It cannot be stressed too often that the training of mapping personnel requires many

months; and, in the case of certain operators, often a year or more is required before sufficient skill is acquired for good results.

Under the above general outline, the following specific recommendations are made for Nevada:

(a) There are approximately 107,000 square miles in Nevada for which it will be necessary to secure aerial photographs suitable for mapping; and, for some areas, additional general purpose photographs will be required. This photography should be accomplished the first year, the approximate cost of \$325,000 to be made available to the U. S. Geological Survey, who would contract and be responsible for inspection of the photographs.

(b) Provide for immediate expansion of first order horizontal control surveys by the U. S. Coast and Geodetic Survey at the close of the war, at frequent enough intervals to provide basic datum from which mapping agencies could extend surveys of a lower order and accomplish the field work necessary to make planimetric maps. This work could probably be accomplished in a three-year period by extending surveys in those areas where no surveys of a lower order exist, and by making connections to the many lower order surveys in Nevada executed by the U. S. Geological Survey, the U. S. Forest Service, the Nevada State Highway Department, and other organizations. This work would probably require an expenditure of approximately \$400,000 for the three-year period. These control surveys are necessary before any map work can be accomplished from aerial photographs and failure to provide for this phase would defeat the entire program.

It is recommended that funds spent for control surveys by the U.S.C. & G.S. in Nevada be concentrated on triangulation, holding leveling to a minimum.

(c) Arrange for complete planimetric mapping from aerial photographs by modern stereoscopic plotting methods, at a scale of 2 inches to the mile over a five-year period; *and defer all topographic mapping, except in areas of specific importance, until the completion of the planimetric mapping.*

Many of the State and Federal agencies in Nevada must construct new base maps showing planimetric detail after the war at scales ranging from 1 inch equals 2 miles to 1 inch equals $\frac{1}{2}$ mile; and unless good base maps are made available within a five-year period, these organizations will be compelled to prepare their own.

(d) It is recommended that the U. S. Geological Survey establish in each State an office to act as a coordinating agent in planning the mapping program; through this agent to arrange for cooperative action by all the map-using agencies concerned, especially in those areas where their interests are predominant, in which they would cooperate in the extension of supplemental ground control, picture pointing, map compilation, field checking, etc. To expedite the preparation of plans for such a program, to make investigations of available equipment and personnel, and to program future work, funds should be made available immediately to the U. S. Geological Survey, this agency to estimate the amount required for the opening phase.

In making their estimates, the U. S. Geological Survey should investigate the practicability of utilizing personnel of other governmental agencies who are familiar with the area over which they have jurisdiction, and suggesting to them the amount of personnel, equipment, etc., which will be necessary, so that these organizations may provide in their budgets for this additional work.

In order that the needs of all interested parties may be more nearly satisfied, it is recommended that the U. S. Geological Survey establish a local Board of Maps and Surveys, in which membership would be extended to all State and

Federal agencies in Nevada using maps or now spending funds for map construction, and that this Board meet regularly to present its problems and advise the directing agency.

This last is deemed of specific importance, as any failure to meet the general requirements of all concerned would result in a return to the present system of each department necessarily attempting to supply maps for its own purposes. It is self-evident that the existing National map coordinating program has failed to function in this State and a local organization familiar with local problems is necessary.

The cost of producing planimetric maps of the 107,000 square miles in Nevada for which there are no such maps is estimated at \$700,000 over and above the cost of photography and first order control by the U. S. Coast and Geodetic Survey.

Although the amount of money required to complete the job contemplated in this program amounts to a sizable sum, it must be borne in mind that unless a National mapping program is carried out which will result in a product of uniform standard and usable to all concerned, nearly as great an amount will be expended by the individual agencies producing base maps to meet their own requirements, but which will not be up to National standards. There seems no doubt that sufficient funds have been expended for base maps in Nevada since 1930 to have finished the work called for in this program; but because of the lack of cooperative and unified action, such as is herein outlined, only an insignificant area is now adequately covered.

(e) Inasmuch as the greater portion of Nevada is public land, which a number of government agencies are called upon to administer, and such administration is dependent upon the identification furnished by legal subdivisions provided through the public land system of surveys, it is recommended that in addition to regular funds which the Public Survey Office receives each year for the subdivision of land into sections, it be given a supplemental appropriation for the purpose of executing township boundary surveys only; and that the interior subdivisions be made only in those cases where conditions require. With such boundary surveys and accurate planimetric maps the section lines can ordinarily be protracted with sufficient accuracy to provide the administrative detail needed; and if a policy of complete subdivision of townships is followed, even with a greatly expanded personnel, it would be many years before the surveys of the State could be completed. These supplemental boundary surveys should be so programmed through the coordinating agent that they could be utilized as picture control, thus avoiding in many areas the extension of supplemental triangulation of the lower order necessary for making planimetric maps. It is recommended that not less than \$150,000 be furnished each year for a five-year period for township boundary surveys.

It is further recommended that the General Land Office consult this group in outlining and programming its work.