NOTES ON WORK OF THE U. S. GEOLOGICAL SURVEY.

THE TWENTY-SECOND ANNUAL REPORT of the Director of the U. S. Geological Survey for the fiscal year ending June 30, 1901, shows that, during the year which it covers, 35,123 square miles were covered by detailed topographic mapping, this area being distributed through 32 States and Territories; and that 12,407 miles of level were run and 1,338 permanent bench marks established; these bench marks being iron posts, bronze or aluminum tablets, or copper or aluminum plugs. In connection with this work primary azimuth observations were made at four triangulation stations, 37 meridian lines were established, 271 triangulation stations were occupied, and 2,088 miles of primary traverse were run. In connection with the surveys in Alaska, about 6,500 square miles were mapped topographically, thus opening up many new regions, some of which were before entirely unknown; in addition to the mapping, about 150 linear miles of stadia traverse and 274 linear miles of reconnaissance traverse were run. With reference to the surveys of the forest reserves, 23 miles boundary of the Black Hills Reserve and 109 miles of the boundary of the Bighorn Reserve were surveyed and marked. The completion of the topographic work of the year 1900–1901 makes a total, with that previously done, of 866,847 square miles of the United States which have been fully surveyed and mapped, or 29 per cent. of the entire area of the country.

For purposes of administration the territory of the country has been divided into four sections—the Atlantic section, the work of which is controlled by Mr. H. M. Wilson, geographer in charge; the central section, with Mr. John H. Renshawe, geographer in charge; the Rocky Mountain section, with Mr. E. M. Douglas, geographer in charge, and the Pacific section, under the direction of Mr. Richard U. Goode, geographer.

MR. G. L. SWENDSEN, engineer in charge of the hydrographic investigations in Utah, reports that a general conservation of the flood waters is necessary for further development of irrigation or the use of power. Measurements of the Bear River, which flows through a fertile valley in northern Utah, showed that the volume of water which flowed into Great Salt Lake in the last summer season was exceptionally low, less than one-half that of any previ-

ous record. The fact is thus established that the low water flow of this river will be insufficient for the large irrigating canals now being built to take water from it, and a number of other streams in the State reached this point some years ago.

THE NEED OF STORAGE of flood waters is felt in the valley of Carson River, in western Nevada. The soil of this valley is capable of being largely cultivated if water can be furnished, but the supply from Carson River cannot be relied upon for this purpose. This stream rises in California on the eastern slope of the Sierra Nevada Mountains, and, crossing the Nevada boundary, is lost in the great desert "sinks" of the latter State. In spring and early summer, when the river carries the melted snows of the mountain, it is of considerable size, but during the summer it sinks, and its waters are completely lost in the lower portion of its course. Preliminary investigations recently completed have demonstrated that, by the construction of five reservoirs on the tributaries and the main stream, it is possible to impound sufficient water to irrigate 120,000 acres of land now arid.

The estimated cost of this storage is less than $7 per acre which can be irrigated, or about $800,000. The market value of the land, when supplied with water without other improvements, is calculated at $25 per acre, giving an estimated valuation for the whole of $3,000,000. The tract will be capable of sustaining a population of over 30,000.

ONE OF THE FEATURES of the water supply of Texas is the occurrence of artesian springs, which flow from the foot of the escarpment which bounds the south-eastern portion of the Edwards Plateau. These waters are found in springs at Austin, in the San Marcos River at San Marcos, at San Antonio, and elsewhere. They issue from the ground in strong, gushing springs, and flow away in bold streams.

A careful study shows that their flow fluctuates between a high and low discharge. These changes bear a remarkable resemblance to the fluctuations of rainfall on the Edwards Plateau; the crest of the rainfall curve over this region being followed with great precision by the crest of the discharge curves of the springs. The Edwards Plateau is a flat, grass-covered upland, 14,000 square miles or more in extent. The rain which falls upon it sinks into the porous soil, and finds its way to the bold scarp line of the region, where it bursts out in the abundant springs.

The San Antonio River has its source in one of these springs, and between it and the wells driven to supply water to the City of San Antonio there seems to be close connection. It was recently noticed that when the wells were steadily drawn upon for twenty-four hours the water-level of the head lake of the river fell several inches, but that on shutting off the wells the lake regained its level in about one day. So intimate is the relation between the flow of the wells and that of the river that it is always possible to tell how high the water will rise in the former by observing the river's height on a gauge rod placed upon its bank.

ATTENTION IS CALLED by Mr. A. H. Brooks to the extensive water power existing in the narrow portion of Alaska extending southward along the Pacific. Juneau, Sitka, and Skagway are situated in this region, which produces gold and copper, and promises to be an important mining centre. Many of the low-grade ores found here occur in large bodies, and can be worked to advantage by making use of the water power. The topography favours the development of water power; high land and lofty mountains are in proximity to the coast, from which numerous streams, fed by an abundant rainfall, rush to the sea. In the southern part of the belt, more especially in the Ketchikan mining district, the water powers are available for the entire year, owing to the mildness of the climate; while in the Juneau district, in the northern part of the belt, they can be used for about eight months.

LIGHT HAS BEEN THROWN on the underground water resources of southeastern Virginia by a well recently constructed at Fort Monroe. The well was sunk to bed-rock "granite" 2,246 feet, but, although several water-bearing strata were penetrated, they were all found to develop flows of salt water. The results obtained from the Fort Monroe well confirm those found elsewhere in this region. Salt water only has been found in borings at Norfolk, Va., at 760 feet; at Wilmington, N. C., where bed-rock was reached; at the Chamberlain Hotel, Old Point Comfort, at 947 feet, and in several wells at Crisfield, in southern Maryland. These borings indicate that there are no prospects for usable underground waters in the region. Eastern Virginia is underlain by a succession of widely-extended sheets of sand and clays, lying in regular order on an east-sloping floor of granite or other "bed-rock." This rock disappears beneath the surface along a zone passing near Petersburg, Richmond, Fredericksburg, and Washington, and, descending at a

rate varying from 40 to 100 feet per mile, reaches a considerable depth near the ocean—2,246 feet at Fort Monroe. The sands of the overlying formations contain water which is abundant and fresh for the first 40 to 50 miles from the west, but is now known not to be available in the extreme southeast. Numerous fine-flowing wells have been obtained along the Potomac, Rappahannock, York, and James Rivers from several sand horizons, but about Old Point Comfort, and to the south and east, the upper water-bearing sands have changed into non-water-bearing clays, and the lower sands yield only salt water.

TO ASCERTAIN THE WATER resources of the country it is important to have facts concerning the quality of the water—whether fresh or saline, muddy or clear, etc. The United States Geological Survey is making systematic observations of the amount of material carried in suspension by flowing water, rendering it muddy or turbid, and with reference to the colour of the water from dissolved or suspended matter. The study of the colour and turbidity of water is of commercial importance, because clear water is frequently a necessity in manufacturing, and it should be available for municipal use. The method of investigation of these matters consists, in the main, of comparing a small amount of the water, held in a glass receptacle, with certain colour standards; and, for turbidity, of noting the depth beneath the water at which a small pin can be seen. A description of the methods can be found in Circular No. 8 of the Division of Hydrography.

THE DEEP-WELL BORINGS of the United States, made for water, oil, and gas, are the subject of a statistical report by N. H. Darton in the series of Water-Supply and Irrigation Papers of the United States Geological Survey. The list of deep wells is arranged by States, in alphabetical order, and appears in two pamphlets known as Water-Supply Papers Nos. 57 and 61. All wells 400 feet or over in depth are carefully listed. Depth, diameter, yield per minute, and other characteristic data are given, and many instructive details are noted indicating for what purpose the borings were originally made, the character of the product obtained, and whether the wells are in use or abandoned. References are given to the literature or other sources from which the data were obtained.