RUN-OFF FORECASTS

1954 water supply in the West

Surveys of Western snowpack show meager supply in Southwest, virtual drought in New Mexico and Colorado — Good margin in Northwest — Reservoir storage generally above past 10-yr. average at start of spring run-off, except in drought areas

By CLYDE E. HOUSTON
Senior Civil Engineer

and

HOMER J. STOCKWELL
Hydraulic Engineer
Soil Conservation Service

PROSPECTIVE WATER supplies for western United States in 1954 vary from ample supplies and possible floods on the northern section of the Columbia Basin to an extreme water shortage on the Rio Grande in Colorado and New Mexico. This is the latest summary of water supply conditions as prepared by the U. S. Soil Conservation Service, based on observations on nearly 1,200 snow courses in the mountain areas of the west.[1]

This brief analysis of April 1 snow surveys, again presented by *Western Construction*, shows a wide range of run-off in prospect for irrigation power generation, and municipal and industrial use.

Water shortage continues

The water shortage of the Rio Grande drainage is particularly critical with a combination of low snow cover and lack of reservoir storage. This situation has developed through a series of years of deficient run-off. Although run-off will be slightly more than during other recent dry years of 1950, 1951 and 1953, total water supply will be less in New Mexico. This pattern of low prospective run-off extends to a lesser extent through to central Colorado, southeastern Utah, and Arizona. Record spring storms during the latter part of March materially improved the outlook for the Salt River in Arizona. Reservoir storage was increased 250,000 ac. ft. and soil moisture conditions are good. The storm did not reach the watershed of the Gila River. Previously, record low streamflows were expected.

In Utah, supply will be near average with some shortage in the Bountiful-Farmington area of north central Utah.

Nevada snow storage is very spotty. It ranges from about one-third of normal in the north to near normal in the Sierra Nevada.

The snow cover on the Columbia River Watershed as a whole is heavier than in 1948. However, it is only remotely possible to have a re-occurrence of the late snow melt and spring rains of that year which produced the record flood flows of 1948. Heaviest snowfall has been in northern Idaho, Montana, and southern British Columbia, and on the east slope of the Northern Cascade Mountains. Other sections of this basin, in southern Idaho, northern Nevada and southeastern Oregon, have been extremely deficient in snowfall during the winter months and summer streamflow will be short. Water supply in most of Oregon will be generally good. Seasonal snow accumulation is normal and 90% of last year.

The following forecasts of streamflow for the major rivers of the West for the April-September 1954 period will indicate general watershed conditions at the start of the run-off season. The flow of the Columbia at The Dalles, 123% of normal; Colorado near Grand Canyon, 67%; Upper Missouri River and tributaries will average about 110%; Platte River and tributaries, about 65%; and, Rio Grande, about 50%.

Storage in irrigation reservoirs is generally above the past ten-year average except in the drought areas of Colorado and New Mexico.

In the following paragraphs the water supply situation is briefly outlined for each state. Charts indicating current status of reservoir storage and a map showing approximate run-off summarizes the outlook for the coming season.

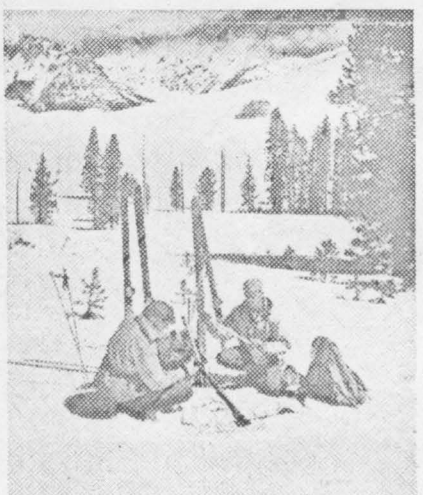
ARIZONA

Water prospects on the Salt-Verde system are fairly good, but the out-

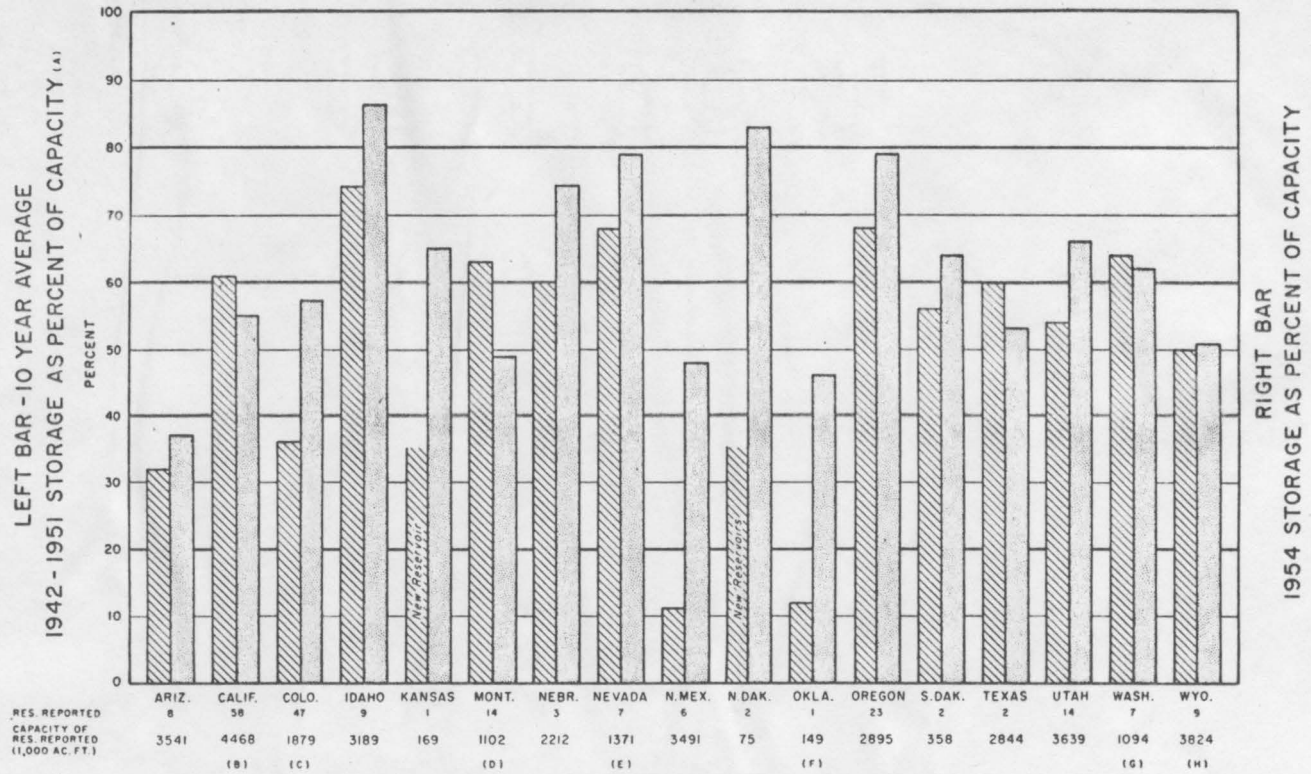
[1]*The Soil Conservation Service is the Federal coordinating agency of snow surveys conducted by its staff and many cooperators, including the Bureau of Reclamation, Forest Service, National Park Service, Geological Survey, various departments of the several western states, irrigation districts, power companies, and others.*

The California State Division of Water Resources conducts and coordinates snow surveys in that state, while the British Columbia Department of Lands and Forests, Water Rights Branch, has charge of the snow surveys in that province.

The U. S. Weather Bureau makes Westwide Water Supply Forecasts at more than 320 gauging stations, such forecasts being estimated principally on the basis of measurement of precipitation. The Weather Bureau forecasts are for the water year (October-September inclusive), whereas snow survey forecasts are always for the irrigation season only.



SNOW MEASUREMENTS are made in the same location in the mountains (left) from year to year. These men are measuring carefully the location of the next sampling point in the snow course. (Right) Examining and testing snow sampling equipment before leaving for the snow course.



RESERVOIR STORAGE AS OF APRIL 1, 1954

Explanation: (a) Most state averages for reported reservoirs are for full 10-yr. period, but in a few cases reservoirs having shorter records are included. (b) Does not include Shasta, Millerton, or Pine Flat reservoirs (combined capacity 6,120,500 acre-feet); April 1 combined storage 4,191,530 acre-feet. (c) Does not include John Martin Reservoir (capacity 655,000 acre-feet); April 1 storage 15,600 acre-feet. (d) Does not include Fort Peck Reservoir (capacity 19,000,000 acre-feet); April 1 storage 12,180,000 acre-feet. Does not include Flathead Lake (capacity 1,791,000 acre-feet); April 1 storage 616,100 acre-feet. Does not include Hungry Horse Reservoir (capacity 3,500,000 acre-feet); April 1 storage 1,947,000 acre-feet. (e) Does not include Lake Mead (capacity 27,217,000 acre-feet); April 1 storage 15,701,000 acre-feet. (f) New reservoir in 1945. (g) Does not include Roosevelt Lake (capacity 5,172,000 acre-feet); April 1 storage 2,933,000 acre-feet. (h) Does not include Boysen Reservoir (capacity 758,000 acre-feet); April 1 storage 382,100 acre-feet.

CORRECTION: Graphed values (bar heights) for states of Colorado, New Mexico, Oklahoma, and Texas are in error. In each case, values for right and left bars should be reversed; e.g., for New Mexico 10-yr. average storage is 48% of capacity; and 1954 storage is 11%.

look for the Gila-Frisco is poor. Moisture from the storm of March 22-24 did not reach into the Gila drainage sufficiently to make up the existing deficiency. This storm was a record for this time of year, exceeding all late storms back to 1905, and resulted in a more optimistic outlook for water on the Salt-Verde area. Prior to the storm all streams were expected to establish record low flows that would probably not have been equalled for many years. Present outlook, entirely due to this storm, is for median conditions.

The Gila area, particularly the San Carlos project west of Florence, still faces an extreme shortage of water. The 40,000 ac. ft. of water produced by this storm, and perhaps 10,000 additional that can be anticipated, will not serve to carry the project for long. There are 100,000 acres within the project. The balance of water needed will have to come from pumps located in the already over-developed ground water basin in Pinal County.

BRITISH COLUMBIA

According to the Water Rights Branch of Provincial Department of Lands and Forests, most snow courses in the Columbia, Kootenay, Similkameen, and Skagit basin in British Columbia have snow water contents which are by far the heaviest ever recorded for this time of year. Observers in these areas report no sign of thawing, little run-off and continued cool weather. The results of their measurements reveal that a deep snow pack of low density exists which indicates that the snow has not begun to ripen in preparation for the spring thaw. The soil mantle under the snow is generally reported as unfrozen but well primed with moisture.

Largest run-off on record

The April to September run-off in these areas is predicted to be from 30% to 50% above the ten-year normal and if this actually occurs, will result in most cases with the largest run-off on record. Consequently a serious flood potential now exists and a gradual well ordered snow melt will be necessary to avoid peak discharges.

Snow packs in Okanagan basin, however, are near normal and an inflow to Okanagan Lake is expected to be about 15% below normal. This area can anticipate good water supplies from snow melt.

CALIFORNIA

The California Division of Water Resources reported that the water supply in California will be near or above normal north of the latitude of Oroville, slightly below normal in the remainder of the Central Valley and southern Lahontan areas and considerably below normal in the Santa Clara and central coastal and south coastal areas.

The snow pack averages slightly less than one year ago in the Cascade Mountains and the northern Sierra Nevada and is greater than one year ago on the watersheds south of the Stanislaus River. The water content determined by snow course measurements varies from 80% of normal on the Yuba, American, and Mokelumne River Watersheds, to an average of about 105% of normal on the Upper Sacramento and Tule River Watersheds. Normal or above normal snowmelt run-off is expected in streams of the north coastal area and in the Upper Sacramento River in the Central Valley area. In the remainder of the Central Valley area, snowmelt run-off may be expected to vary between 92 and 72% of the 50-yr. normal in the Feather and American rivers.

Storage in California reservoirs utilized for conservation is above normal for April 1 except in the south coastal area. With normal conditions, such reservoirs on streams tributary to the Central Valley area may be expected to fill during the snowmelt period.

Run-off during the six-month period ending March 31, 1954, has been below normal on streams other than those in the northern part of the north coastal area and on the Upper Sacramento and Napa rivers.

Predicated on estimated recharge and average conditions of draft, groundwater levels throughout the state in the fall of 1954 will in general be lower than those of 1953. Measurements made during March indicate that lowering in groundwater levels is generally prevalent in the important groundwater basins. Rises in groundwater levels were reported from a few locations in the San Francisco Bay, south coastal, and Central Valley areas, and generally over the central coastal areas.

COLORADO

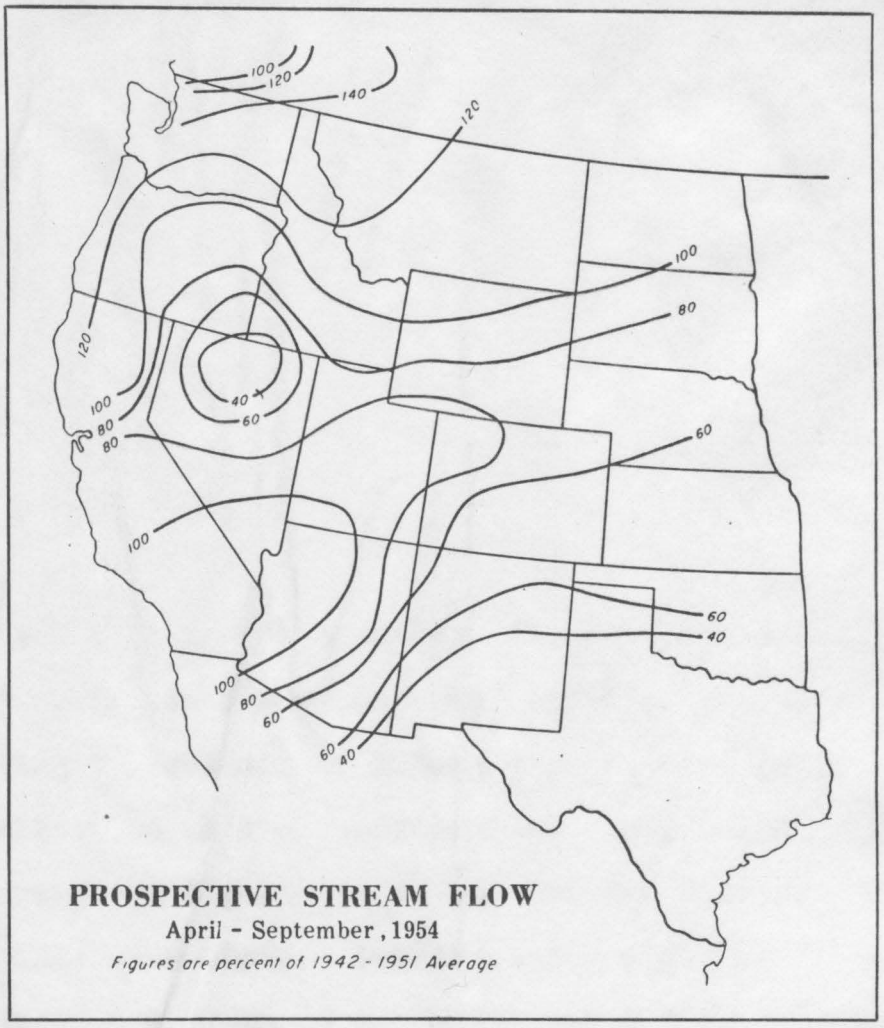
Summer discharge of all streams originating in the mountains of Colorado will be less than normal in 1954. Precipitation at high elevations was extremely deficient during the fall months. Seasonal snow accumulation has been below normal. Snow water content on high elevation courses ranged from 70% of normal to near normal as of April 1. All medium and low elevation courses were less than 75% of normal. Summer run-off on the Rio Grande, Colorado, and Arkansas rivers and their major tributaries is expected to be in the range of 60 to 70% of normal. Some South Platte tributaries, the North Platte and Laramie rivers will have slightly higher summer run-off.

Soil moisture conditions in irrigated areas are fair to poor east of the Continental Divide and fair to good on the west slope of Colorado. Storage in irrigation reservoirs is substantially below a year ago and is below the past 10-yr. average. Water shortage may be expected in all areas except where there is a considerable amount of supplemental water available as in the Northern Colorado Conservancy District. Most critical shortages are expected on the lower Arkansas and on the Rio Grande.

IDAHO

Northern Idaho Rivers have a record snow pack with excellent water supplies forecast for 1954. Serious flood potentials exist on the Kootenai, Clearwater, Spokane, and Pend Oreille Rivers. The most vulnerable flood plains are along the Kootenai River which has the greatest snow pack ever recorded since snow surveys began on the watershed in 1937. With normal spring conditions this river is expected to peak at 100,000 sec. ft. as measured near Leonia, Idaho. Serious flood damage can result when the river goes over 90,000 sec. ft.

In southern Idaho, prospective water supplies are poor as a result of a light snow pack. Prospects for the southern tributaries to the Snake River vary from 22 to 41% below normal.



PROSPECTIVE STREAM FLOW
April - September, 1954
Figures are percent of 1942 - 1951 Average

MONTANA

The 1954 snow pack over the Columbia River Basin in Montana is exceptionally heavy this season. The Kootenai River Basin has a record snow pack and a flood potential exists. On the Flathead Basin the snow pack is 20% greater than in 1953. The South Fork of the Flathead should flow 2,710,000 ac. ft. of water from April through September, or 120% average. The Flathead at Polson should reach 8,747,000 ac. ft. for the April-September period or 125% average. The Clark Fork River above Missoula is short of snow cover this season and is expected to flow 90% average. The Bitterroot River has a fair snow pack and is anticipated to flow 107% average this season.

The Upper Missouri Basin in Montana has an average snow cover except for the Marias, Teton and Sun Rivers. These streams reflect the Columbia Basin conditions with a snow pack much higher than last season and 174, 163, and 132% of the 6- to 15-yr. average respectively. A flood potential on these streams could be realized under adverse precipitation and temperature conditions early in the run-off season.

The Yellowstone River Basin through Montana has approximately a 115% average snow pack which should produce a fair water supply from April through September. The Clark Fork of the Yellowstone has below normal snow cover and is expected to flow approximately 82% average from April through September.

NEVADA

Nevada's outlook for 1954 water supplies from snowmelt is spotty. Snow stored water throughout the state ranges from very poor in the north to fair in the central section and excellent in the southern section. Along the Humboldt tributaries, streams can be expected to flow from 40 to 80% normal while the main stem will flow about 50% normal. Run-off into Nevada from the east central Sierra will range from 75% in the north to 85% normal in the south.

Users of snow fed streams in the southern desert section of the state can expect as high as 150% normal flow. October through March streamflow at key stations on the Humboldt and eastern Sierra was 90 and 100% normal respectively. In general, groundwater levels are below normal.

April 1 reservoir storage in seven important reservoirs was 79% of capacity and 115% of the past 10-yr. average.

NEW MEXICO

The water supply outlook for New Mexico is possibly the worst in recent years. Streamflow is expected to be slightly higher in the Rio Grande than for the years 1950, 1951 and 1953. However, storage in irrigation reservoirs is extremely low. Total reservoir storage and expected streamflow combined will equal less than one-half of the normal irrigation water demand. Pumping will be used to help alleviate the shortage in the Mesilla Valley.

Precipitation in valley areas has been negligible and soils are extremely dry. Similar conditions exist along the Pecos except that reservoir storage is slightly better than for the Rio Grande. Soils in the Carlsbad and Roswell districts are extremely dry.

OREGON

Water supply outlook for 1954 in Oregon is fair to excellent. Near average streamflow is expected except in the far eastern portion of the state. Water supplies will be adequate in western Oregon and in all areas where storage water is available. Some eastern Oregon lands will have late season shortages unless adequate May-June rains are received.

Water content of mountain snow averages 102% of normal based on 106 long-record, snow courses and is 89% of last year. Reservoired water in 23 reporting reservoirs is 116% of average. Mountain soils are well wetted except in the extreme eastern part of the state.

UTAH

There are two small areas in the state which have very poor run-off prospects. The Farmington-Bountiful area of the central Wasatch front in northern Utah has the poorest snow cover since the drought year of 1934. In southern Utah on the East Fork Sevier River-Escalante River, in spite of the heavy snow accumulation of March, snow cover is still only 50% of average, although about one-third more than last year. Elsewhere in the state, run-off prospects vary from 60 to 134% of average.

Water users having river storage rights will in general have sufficient water for their needs during the coming summer. Water users having only natural flow rights in those sections of the state other than southwestern Utah and the Uinta Basin, can anticipate below average late season water supplies, unless a very cold, wet spring develops.

Holdover storage in fourteen reporting reservoirs is 66% of capacity. This compares with 54% of capacity for the period 1942-1951.

WASHINGTON

The Chelan River in Washington has the greatest snow pack measured in the 24 years that the snow course network has been in operation. This snow pack is 62% above normal. Other rivers in Washington also have a very heavy snow pack and water supply prospects are excellent throughout the state.

A flood potential exists on the main stem of the Columbia River as measured near The Dalles, Oregon. This major river also has a record snow pack that is expected to produce an unregulated peak of 760,000 sec. ft. Unusually heavy spring rains and a late snowmelt could raise this peak to a serious magnitude.

WYOMING

The snow cover throughout the State of Wyoming ranges from above normal in the Snake River Basin, Wind River Basin, Big Horn and Yellowstone Park Watersheds to 80% of normal in the North Platte, Laramie River and Pole Mountain drainage areas. This is the second year in succession that the southern part of the state has experienced a sub-normal snow pack and the seriousness is now increased by the reduced storage in the North Platte and Laramie River reservoirs.

Above normal temperatures indicate an increase, from winter melt, in the soil storage of late last fall. However, a soil deficit remains over most of the state and this will reduce the snow melt run-off indicated by the snow surveys.

Reprinted from

WESTERN CONSTRUCTION

May 1954