



## History of Agricultural Experiment Station and Colorado Water Issues

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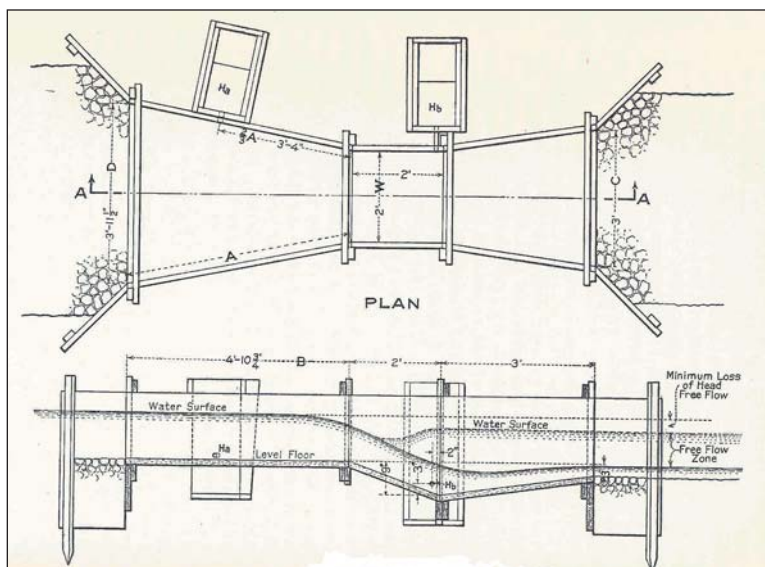
The Colorado Agricultural Experiment Station (AES) was established by the Colorado Legislature in 1888, following enactment by congress of the Hatch Act of 1887, which authorized funding for such research facilities at all existing and future land-grant institutions. The Colorado station was organized as a research agency under the administration of the recently opened state Agricultural College at Fort Collins. The principle mission of these agricultural experiment stations was to conduct research and experimentation to benefit the nation's agricultural industry.

Water resources research was firmly imbedded in the mission of the Colorado AES from its inception. The original organizational structure called for five sections of inquiry, one of which was the meteorology and engineering section. Although the main station was located in Fort Collins, the first two sites designated for substations, Del Norte and Rocky Ford, were located in areas where irrigated agriculture already had a rich history. The inaugural issue of the Bulletin series of Colorado AES publications was titled, "Report on Experiments in Irrigation and Meteorology."

This early emphasis on water studies by the AES was the product of converging events, both at the state level and within the new College itself. By the time the Hatch Act was passed, Colorado had demonstrated its leadership among western states in the practice of irrigation and the development of legal structures for administering irrigation water rights. Total land under irrigation at this time was estimated at 1.25 million acres. With the development of irrigated agriculture, the legislature created a system of water allocation including water courts to issue decrees and administrative structures to divide the water among users based on their priority according the Doctrine of Prior Appropriation. The division of water under this system was administered at the state level by the State Engineer, who was charged with making measurements of the amount of water available for irrigation use.

Internally, two key personnel decisions that would lead eventually to an institutional focus on water occurred within the young College's brief 10-year history prior to the establishment of the Station. The first of these involved the hiring of Elwood Mead as a temporary mathematics instructor. Mead's background in civil engineering led him to pursue knowledge of irrigation principles at a practical level, which led first to irrigation engineering courses and eventually to the formal establishment of a Department of Physics and Engineering, within which he led instruction in irrigation engineering. When Mead left the College in 1888 to pursue a distinguished career in public service, the institution hired a replacement,

Louis G. Carpenter, whose passion for irrigation engineering proved to be equal to that of Mead's. Within a year of Carpenter's appointment, the State Board of Agriculture, the College's governing body established irrigation engineering as one of only four distinct courses of study that could be pursued by undergraduates during their junior and senior years.



Schematic Diagram of a Parshall Flume

(source: Colorado Agricultural Experiment Station Bulletin No. 336. Reprinted with permission)

Although Mead left the institution prior to the establishment of the AES, his insight

into the most important information needs of the irrigation industry in Colorado greatly influenced the early research agenda of the Station. He invested much effort in observing how the irrigation infrastructure functioned. In the process, he developed keen insight into the critical needs of irrigated agriculture and initiated research studies to answer the most pressing questions. Carpenter, who became the head of the irrigation engineering section after the Station was established, enthusiastically sustained the effort initiated by Mead.

The original AES investigations in irrigation engineering were a direct response to critical problems of the time. With the rapid expansion of irrigated acreage in the South Platte, Arkansas, and Rio Grande basins, overappropriation of exist-

ing supplies was becoming more common. Administration of water rights under these conditions required more accurate measurements of water use variables. Early AES-sponsored research led to the development of devices that improved the accuracy of water measurement and efficiency of water distribution in ditch systems. In addition, critical studies were conducted to determine the duty of water – the amount of water required to meet crop requirements without waste – for various conditions and the factors affecting the rates of evaporation from open water surfaces. Mead and Carpenter also initiated long-term studies on the climate of Colorado during this early period. This work was designed to answer questions about the potential for irrigated agriculture to produce overall changes in climate in the region.

These early research initiatives clearly established Colorado Agricultural College's reputation of excellence and leadership in irrigation studies. Continued AES support of irrigation research during the early period of the Twentieth Century was instrumental in maintaining the institution's leadership. The most visible work during this period was the result of collaborative research between the Station and the Irrigation Investigations Office of USDA. Ralph Parshall, a graduate of Colorado Agricultural College in 1904, was employed by this agency in 1913. Parshall, who was also appointed to the Station staff in Fort Collins, provided outstanding leadership in several areas of inquiry that brought widespread recognition to the institution. His most notable contribution was the development of the Parshall flume, a simple device for providing accurate measures of water flow in open channels. By 1925, this device was accepted as the standard for water-flow measurements by irrigation engineers world-wide. Other contributions by Parshall included studies, first conducted by L. G. Carpenter, to document the contribution of water seepage from irrigation to return flows to the lower South Platte River. Parshall also participated in the first mountain snow surveys, which continue to the present day and serve an important role in forecasting water availability from snowmelt.

From these early contributions to the present era, support of water research by the Colorado AES has been a vital force in providing science-based information for water resources managers in Colorado and elsewhere. Topics of investigation have included surface and ground water hydrology, the economics of irrigation practices, irrigation scheduling, the economic value of water for irrigation and other purposes, the impacts of irrigation water transfers, consumptive irrigation water use by crops and urban landscapes, and various aspects of irrigation water management. The Station has continued to invest in long-term climate observations through its support of the Colorado Climate Center. Currently, the AES funds a wide array of water projects that account for the entire range of water issues of concern to society. Examples include emphasis on irrigation impacts on soil salinization, nutrient contamination of surface and ground water, and fish and wildlife habitat; water use by urban landscapes and lawns; and drought assessments.

When we review the entire record of AES contributions to water resources research in Colorado, several important themes emerge. The earliest contributions by the Station were vital to agricultural industry in Colorado. Much of this work provided information that was essential to the implementation of water administration systems in Colorado and elsewhere in the western US. In the longer view, the continuity of support over more than 100 years has provided a stable source of funding for climate observations. This stability also has provided the flexibility to deal with emerging problems that reflect changing societal values. From its inception, the Station has supported research that has brought significant recognition to the institution as a whole. It has also fostered collaboration with scientists and water managers from a wide range of federal and state agencies.

In the final analysis, one can conclude that AES support of water resources research in Colorado has fulfilled the intent of the Hatch Act. Federal and state funding support has combined to greatly benefit the state's agricultural industry. In the process, Colorado as a whole has received a watershed of benefits from the information generated by this important investment in research.

### Father of the Flume: Ralph Parshall

Ralph L. Parshall (1881-1959) may be one of the most celebrated internationally-known alumni in the history of Colorado State University. A pioneer in the fields of civil engineering and hydrology, Parshall is best known for developing the Parshall Flume at the then-named Colorado Agricultural College's hydrology lab in 1922. Noticing problems with stream flow measurements, Parshall developed the device that, when placed in a channel, measures the flow of the water as it uniquely relates to water depth. Today, the Parshall Flume is still widely used to help gain more accurate measurements of water flow.

An exhibit created by the Water Resources Archive depicts events in Parshall's long and productive association with what is now Colorado State University. From his start at the college as a freshman in 1899 to his development of the flume and subsequent honors from the College, Ralph Parshall's career is traced through photos and personal objects, highlighting the remarkable successes that have served to make him such a recognized and remarkable alumnus.

The exhibit will be available for viewing until December 20 in Morgan Library, Suite 210, Monday-Friday, 8:30-4:30.