Water Development History

When most people think of Colorado they think about our mountains and their majestic scenery. They also think of the rushing streams and rivers and our irrigated agriculture. The Colorado we know today is an illusion that would disappear if the projects that those who preceded us built were to be removed from our landscape.

Mesa Verde

The limited water supplies and the need for the storage of water has always played a significant role for water users in Colorado. The first examples of using storage to meet the drinking needs of the people who lived in Colorado exists at Mesa Verde. At the Far View Ruin a large doughnut shaped depression was constructed around 750 A.D. as a reservoir that would provide a domestic water supply for nearby Far View Village and other dwellers in the immediate area. Many other reservoirs like this one have also been found in the park.

San Luis Peoples Ditch

The oldest continually used irrigation ditch in Colorado was constructed in the spring of 1852 on Culebra Creek near the town of San Luis by settlers who came from New Mexico. Knowing that irrigation water was needed, in order to provide adequate water for their crops, the settlers proceeded to dig what is known as the San Luis Peoples Ditch. This ditch was constructed by the Spanish American settlers, six years before the first gold discoveries were made near Denver.

Gold Rush

When the 'Gold Panners' came to Colorado in 1859 they discovered that the amount of sand and gravel that could be sifted in a pan was limited. Soon some of them came up with the idea of filing claims on promising gravel bars in high altitude streams. Then they followed that with the building of rock or log dams in the stream in order to divert water into a sluiceway. Serious problems soon arose. Miners changed the way water was viewed in Colorado--from something that fell free from the skies to be shared by one and all, to being something that was owned and fought over.

Irrigation efforts

Individual efforts

Some of the unsuccessful gold seekers stayed in Colorado to farm. If they were unsuccessful in getting gold by prospecting they decided they would try to get it by the crops they raised. They knew that the men in the mine fields and the new towns that were springing up would need food for themselves as well as for their animals.

The first settlers located in the meadows near the streams, where native hay could be watered by flooding and later harvested very easily. When they first began constructing ditches they were small and for the most part served an individual farm. Most of the ditches constructed in the 1860's were built by an individual or two or three farmers joining forces. Often these ditches were too poorly and hastily constructed to be long lasting. Spring high waters in the rivers often destroyed the crude diversion

structures, inundating the entire system and damaging the fields. The lack of resources, both labor and financial, were to blame.

Later as more neighbors combined their efforts they constructed slightly larger and longer ditches and diverted water out of the river bottom. In few cases did the early ditch builders have to make a cut of more than five feet in order to place the bottom of their ditch level with the bottom of the stream. They seldom constructed diversion dams. A temporary structure made of bags of sand, downed trees or a combination of stones and brush, required only a few hours to be built. Head gates were an exception rather than a rule.

Community Effort

The next period of development, known as the community effort, started in 1870. Settlers began to pool their labor, horses and funds and formed mutuals or colonies. They took out even longer ditches than their predecessors, to convey the water to the bench lands that in many cases were over thirty miles or more from the headgate and the river.

Corporate Era

Next came the "corporate era" , companies like the English Company and Traveler's Insurance Company, which built big irrigation ditches in almost every major river drainage in Colorado, to encourage people to move to Colorado to live on lands located under the irrigation ditches that they constructed. T. C, Henry worked for Traveler's Insurance and he knew that little could be accomplished without large canals. He eventually was involved in the construction of 12 large ditches throughout Colorado in the South Platte, Arkansas, Rio Grande and Colorado River Basins.

Reservoir Era

Many of the streams on the eastern slope became over appropriated by the late 1870's and early 1880's. The potential of capturing the runoff from the snow in the mountains and spreading it out over the summer months was seen as additional source of water. This ushered in the era of reservoir and dam building in the late 1800's. The reservoirs were usually very junior in the priority system and only stored water during the non irrigation season or during periods of high runoff in the spring or summer following intense rainstorms.

Many of the first irrigation water storage structures were constructed under existing irrigation systems. The reservoirs were mostly constructed by those who had junior water rights, without it, they couldn't irrigate their farms directly from the river for long before they were called out by senior rights holders. Almost without exception, the first reservoirs were constructed for the purpose of supplementing the direct diversions from the river by making direct releases to downstream calling senior water rights and then diverting a like amount of water as a result of the exchange that occurred. Many of the first reservoirs that were constructed by these ditch companies were the result of enlarging natural lakes.

In 1882 the building of relatively large reservoirs was begun with the construction of Chambers Lake in the channel of the upper reaches of the Cache la Poudre. Many large reservoirs followed that were constructed not only to meet the needs of the farmers but also to meet the needs of the cities. Cheesman Reservoir constructed in 1905 was constructed for the City of Denver.

Transbasin Diversions
South Platte River Basin Projects

The earliest transbasin diversions were not for agriculture, but for placer mining. In 1860 a ditch was built across Hoosier Pass, taking water from a tributary of the Blue River and using it to work a high placer on the middle Fork of the South Platte River above Alma. Another early ditch constructed by miners was the Ewing Ditch which diverted water from a tributary of the Eagle River across Tennessee Pass to a mining area above Leadville.

By the 1880's the rush to secure water rights on the South Platte River and its tributaries had resulted in so many claims that late-comers were often denied water in the latter part of the summer. Because there was relatively little irrigation in the Colorado and North Platte River basins at that time, the appropriation dates for the new trans mountain ditches were relatively senior in the west slope, and the East Slope users could be certain of obtaining dependable water supplies to meet their needs.

The Larimer County Ditch Company, known today as the Water Supply and Storage Company, was the first Irrigation Company to construct a transmountain diversion for irrigation. The ditch they constructed was called the Cameron Pass Ditch. It diverted water from Michigan Creek drainage to the Cache la Poudre watershed. The ditch was small, only one-half mile long. This ditch has an appropriation dated July 30, 1882.

Next followed many transmountain ditch systems that also diverted water into the Cache La Poudre River Basin. Work began on the creation of a channel to divert water from the Grand River (later renamed the Colorado River) on the west side of the Continental Divide, and to deliver it to farms east of the mountains. Considered an engineering marvel at the time, the channel began sending water eastward in 1890 with 8 miles of ditch across a high mountain pass, dug by hand primarily by Japanese and Mexican laborers. By 1936, with the help of machinery, the ditch extended to 14 miles through the Rocky Mountain National Park. First called the Grand River Ditch, it was renamed the Grand Ditch after the name of the Grand River was changed to the Colorado River in 1921. The ditch is about 20 feet wide and 6 feet deep, although the water is usually no more than 3 feet deep. The ditch starts at an elevation of about 10,300 feet, to where it crosses the La Poudre Pass, at an elevation of 10,179 feet. From the La Poudre Pass, the water flows into a reservoir, Long Draw Reservoir, then into the Cache la Poudre River, and finally to the Larimer Weld Canal near Fort Collins.

Farmers in the Cache la Poudre River basin numerous other transmountain diversions. They constructed the Michigan Ditch which also diverted water from the Michigan River Basin. They also constructed 5 transmountain Diversions from the Laramie River Basin the largest of which is the Larimer Poudre Tunnel.

In 1904, the newly established United States Reclamation Service (USRS) completed a study which suggested raising the elevation of Grand Lake 20 feet and included the construction of a 12-mile tunnel from Grand Lake to either the Big Thompson River or St. Vrain Creek. This proposed project was heavily supported by water users in the Cache La Poudre Basin.

It wasn't until Dec. 1, 1938, however, that construction of the Colorado Big Thompson Project began with the construction of Green Mountain reservoir. The Green Mountain Reservoir was constructed as a

compensatory storage reservoir which provided water for existing and future Western Slope growth and development. In December 1941 the construction of Lake Granby began. The lake stores water for diversion to the Eastern Slope. It collects water from the Colorado River and its tributaries and saves it for pumping into Shadow Mountain and eventually into Grand Lake.

From Grand Lake the water flows into the Adams Tunnel. A rock fill embankment, the East Portal Dam creates a pond for the regulation of outflow from the Adams Tunnel and provides a head works for the Aspen Creek Siphon which delivers water to Mary's Lake. The CBT project resulted in 13 dams and 10 reservoirs being constructed which includes Carter Lake Reservoir and Horsetooth Reservoir. Power generation supplies an additional 18 pumping plants and 11 power plants.

Other parts of the South Platte River system also looked to the west as a source of water supply. In this case the water user was primarily the Denver Water Board. The first of the diversion system they pursued was from the Williams Fork and Fraser River basins. The Denver Water Board began construction of its northern collection system in the 1930's. The Gumlick and Vasquez tunnels deliver water from the Williams Fork Basin. They also constructed a 27 mile collection system involving open and buried closed conduit system to collect runoff to the Fraser River system. The water is delivered to the Moffat Tunnel which was originally constructed as a first bore to aid in construction of the tunnel for trains crossing the continental divide. The delivered through the Moffat tunnel is delivered to South Boulder Creek and Gross Reservoir. From Gross Reservoir it is tunneled to Ralston Creek and Ultimately to Ralston Reservoir to meet the needs of Northern portion of the City of Denver. As compensation to west slope water users Williams Fork Reservoir was constructed to meet downstream senior water rights requirements. It also provides replacement energy when Denver is diverting water upstream that impacts Green Mountain Reservoirs power generation capabilities.

Denver completed the 23.3 mile long Roberts Tunnel in 1962 which delivers water from Dillon Reservoir to the North Fork of the South Platte River. Roberts Tunnel was under construction 16 years and is the world's longest major underground water tunnel, it is nearly as long as the Chunnel under the English Tunnel. Completed in 1959, the Williams Fork Dam & Power Plant was constructed to send water and electricity to the Western Slope as compensation when Denver diverts water for use on the east slope.

Early Water Commissioner History

The first Colorado law that provided for the regulation of streams was enacted by the first Territorial legislature in 1861. They enacted a statute that provided: That in case the volume of water in said stream or river shall not be sufficient to supply the continual wants of the entire country through which it passes, then the nearest justice of the peace shall appoint three commissioners...whose duty it shall be to apportion, in a just and equitable proportion, a certain amount of said water upon certain or alternate weekly days to different localities, as they may, in their judgment, think best for the interests of all parties concerned, and with a due regard to the legal rights of all..." However, the earliest pioneer irrigators had little need for a law of this character. At that time ditches were small and the water in the rivers was sufficient to meet their needs.

By 1876 when the Colorado constitutional convention was held its delegates were aware of the need to resolve existing and potential disputes among irrigators. It was not a question of what doctrine was to be used but of how the doctrine was to be administered. Actually the clauses in the State Constitution did little more

than officially recognize what was already the law of the land. The new document laid the foundations for state control by declaring the "the water of every natural stream, not heretofore appropriated, within the state of Colorado, is hereby declared to be the property of the public." Drawing on customs evolved in farming communities and in the mining districts, where water was diverted for placer operations, the constitution also stated a new doctrine of prior appropriation:

"The right to divert the unappropriated waters of any natural stream to beneficial uses shall never be denied. Priority of appropriation shall give the better right as between those using water for the same purpose...those using the water for domestic purposes shall have preference over those claiming for any other purpose, and those using the water for agricultural purposes shall have preference over those using the same for manufacturing purposes."

The greater part of the flows of the South Platte River and tributaries had been appropriated prior to 1879. Controversies resulted in physical encounters and often bloodshed. The difficulties had grown so significant that by the time the second General Assembly of the state was to meet in 1879 an effort was made to provide a means for adjudicating the rights of the different appropriators. A statewide convention was called by Greeley irrigators to be held in December of 1878 in Denver. They realized that the courts were too slow to offer protection to growing crops. As a result of that convention it was recommended the following changes be made to the existing laws. First they recommended dividing the State into water districts corresponding with the natural drainage basins; second, the appointment by the Governor of a water commissioner in each district whose duty it would be to divide the water on the basis of prior appropriations; third, a plan for securing a record of priorities through referees' hearings in each district plus recommended the position of State Hydraulic Engineer. The Legislature responded by creating ten water districts, all but one in the South Platte River system, and also provided for the appointment of ten water commissioners. It empowered the District courts to appoint referees to determine the priority of rights on each stream in the ten districts. The legislature refused to provide for a State engineer or for the gauging stations. To economize, the supervision over irrigation was given to the State Board of Agriculture.

The Water Commissioners were to be appointed by the governor upon the recommendation of the County Commissioners located in each water district that was created. Their duties were "to divide the waters of the public streams in times of scarcity among the several ditches and canals, according to prior rights of each. The first water commissioners were put in an unenviable position of not knowing how much water was in each stream and in most cases they did not know how to measure how much water was being diverted by the irrigators.

In the beginning water commissioners were allowed to work a maximum of 80 days a year. They were paid by the county commissioners that they served, if there was more than one county being administered during a specific period of time the counties split cost equally. The water commissioners pay was $5 per day and their assistants were paid $3 per day for a maximum of 25 days. The Water Commissioners could only begin working when they were requested to deliver water according to the priority system due to water shortages.

The Colorado System had been defined but not completed as the Second General Assembly left it; the legislation satisfied neither the lawyers, the ditch owners nor the farmers. Early in January of 1881, another irrigation convention was called by farmers who felt that further changes to the existing administrative system

had to be made. They listened to a talk given by B. S. LaGrange, who was the water commissioner in District 3, which is the Cache la Poudre River basin, on the need for additional irrigation legislation. Those in attendance to the convention then chose him chairman of a committee to write the irrigation bill for presentation to the legislature.

Water Commissioner LaGrange spent most of the 1881 legislative session in Denver and helped in many ways to father this legislation. The previous legislature had refused to provide the irrigators with a State Commissioner of Irrigation and with some legislation for the measurement of the streams. The second bill sought to supply these important elements. It provided for a State hydraulic engineer to measure the irrigable streams. The measure was influenced by the experience of California, where the office of State engineer had been created three years earlier. Colorado's measure had one feature, however, which was a considerable improvement over the California law; it provided that prior to the taking of testimony in an adjudication suit, the State engineer should measure the capacities of the stream and the ditches, and present his measurements as evidence in the application for a water right. This bill had another new feature; it provided for the creation of three water divisions which were based on the South Platte, Arkansas, and Rio Grande basins.

The statute that was passed by the General Assembly stated the office of State Hydraulic Engineer, "was to be appointed by the governor for a two-year term." The principal task was the making of "careful measurements and calculations of the maximum and minimum flow in cubic feet per second of water in each stream from which water shall be drawn for irrigation." The state engineer also supervised the water commissioners in each water district and supervised equitable distribution. *As Elwood Mead later wrote: "To Colorado belongs the credit of having been the first State to enact a code of laws for the public administration of streams, and these laws have directly influenced more people than those of any other commonwealth."*

Technology has always played a significant role in the state engineer's office in aiding river administration. The primary responsibility of the State Hydraulic Engineer was to measure the water in each stream from which water was diverted for irrigation, starting with those most used for irrigation. In 1881 the first incumbent, Eugene Stimson, established gauging stations in the Cache la Poudre River and Big Thompson River. He took readings at each station three times a day and provided a copy of his readings to the water commissioners in those water districts. The 1881 legislation also required the owners of irrigation ditches to construct and maintain, under the supervision of the State Engineer, a measuring device for measuring flow. The installation of the measuring devices on the ditches was critical to enable the water commissioners and the ditch riders to allocate accurately the water from the streams and ditches. In addition, the State Engineer was to compute and rate the amount of water that will pass each measuring device at different stages, in cubic feet per second, and provide each water commissioner with a copy of the results. Stimson found it difficult to accomplish all his duties as a staff of one person and did not accomplish all the duties assigned to him during 1881.

At the Cache la Poudre gauging station the stage of water was observed and a telephone line had been extended the entire length of stream. The water commissioner could then direct the regulation of headgates at any time. Water District three or the Cache La Poudre River basin was further advanced than any other river district in the State in the use of technology to administer its water rights.

The second State Engineer, E. S. Nettleton, was appointed in 1883. When he was appointed State Engineer he brought with him a significant background in irrigation ditch construction. He recognized

the need for measuring devices in irrigation ditches and recommended the use of rectangular weirs, which became the most popular measuring device used in Colorado, until the development in 1915-1926 of the Parshall Measuring Flume by Ralph L. Parshall. His work began by determining the capacities of the various ditches, and gauging the streams of the state. He had to determine the daily and annual discharge of the stream systems and the duty of water for irrigating purposes. He invented devices for the accurate measurement of water from canals for the farmers. He was fortunate in that by the time he assumed the office money had been allocated for an assistant engineer.

In 1883 Nettleton made a proposal to the ditch owners of the Cache la Poudre that they furnish the necessary funds to build a permanent gauging station and measuring flume, at, or near, the site of the previous station constructed by Stimson. He also proposed installing a continuous self-recording gauge. This improved structure and recorder would provide the Water Commissioner of the district with trustworthy data that he could use to determine the amount of water available to the water users in his district.

The Cache la Poudre water users promptly responded to the proposition, and assessed themselves, according to the size of their ditches. They raised the money to construct the measuring flume and gauge house at an expense of about $1,650. This flume was erected in the fall of 1883. It was completed in November, ready for use during the following season.

When the self-recording gauge was placed in position in the gage house constructed for it, many measurements of the river were made of the velocity of the current at various stages, so that a stage discharge curve could be developed. At first, a Fteley meter was used for measuring current velocity, but it soon became apparent to Nettleton that this instrument was entirely too delicate for the type waters encountered at this station, the water was filled with drift material of all sorts. He designed a new instrument that was more suitable for making the measurements. He called it the "Colorado" current meter. His main goal for the new meter was to make it self-clearing, the great defect of the Fteley meter being its liability to error when it was clogged with grass or weeds. A secondary object was to reduce the speed of revolution, the high speed of the Fteley instrument necessitated expensive jeweled bearings, and its delicate construction, made it incompatible with the rough work which was required to be done. Three "Colorado" current meters, were initially made and they saw immediate use in the gauging of rivers and ditches. He described the Colorado Current Meter as working on the same principle as a wind gage. It had five cups revolving horizontally on an axle. One Colorado current meter is still in existence and is at the Smithsonian Institute. The Colorado current meter was very similar to the Price meter which was invented W. G. Price in 1885. A modified form of the Price meter was later adopted as the standard meter for the USGS and is used today by the Division of Water Resources.

Thinking back over time and seeing what the first water commissioners had as information to base their decisions upon when compared to the information system that is available today it is truly amazing the changes that have occurred.