

Twin Lakes Dam and Outlet Works  
Beneath Twin Lakes Reservoir  
T11S, R80W, S22  
Vicinity of Twin Lakes  
Lake County, Colorado

HAER No. CO-63

HAER  
COLO  
34-TWLK.V  
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PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD  
Rocky Mountain Regional Office  
National Park Service  
P.O. Box 25287  
Denver, Colorado 80225-0287

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## HISTORIC AMERICAN ENGINEERING RECORD TWIN LAKES DAM AND OUTLET WORKS

### I. INTRODUCTION

Location: Beneath Twin Lakes Reservoir  
T11S, R80W, S22  
Vicinity of Twin Lakes  
Lake County, Colorado

Quad: Granite Quad (7.5 minute series, 1967,  
photorevised 1982)

UTM: 13/385550/4326260

Date of Construction: 1898-1900

Present Owner: U.S. Forest Service

Historic Use: Dam and outlet works controlled release of  
water from Twin Lakes into Lake Creek.

Present Use: Dam and outlet works were partially dismantled  
with completion of a new dam in 1980. Remains of the dam  
and outlet works are submerged under Twin Lakes Reservoir.

Significance: Twin Lakes dam and outlet works were determined eligible  
under Criterion C for the type and method of construction that  
were employed. The dam is a masonry and earth fill structure  
with four large concrete culverts that serve as the outlet works.  
James D. Schuyler, noted dam engineer, developed the final  
design. The structure is also significant for its association with  
agriculture and settlement in the lower Arkansas River Valley.

Project Statement: In 1980, the Bureau of Reclamation completed construction of a  
new dam at Twin Lakes reservoir about 2,500 feet downstream  
from the historic Twin Lakes dam and outlet works. The  
historic dam and outlet works were partially dismantled,  
inundated and remained under water until 1989. Late that  
summer, the reservoir was lowered so that Reclamation could  
remove two earthen dikes constructed in conjunction with the

new dam. In addition, Reclamation proposed to excavate a channel through the old Twin Lakes Dam, bury the old outlet works concrete structures with material from the channel excavation, and remove the old gate structures from the abandoned outlet works. The Colorado SHPO determined that the proposed removal of part of the outlet works would constitute an adverse effect.

To mitigate the adverse effect, the Colorado SHPO and the Bureau of Reclamation entered into a Memorandum of Agreement with concurrence by the U.S. Forest Service (Pike-San Isabel National Forest and acceptance by the Advisory Council on Historic Preservation. The Memorandum of Agreement stipulated that, prior to further demolition, the Twin Lakes dam and outlet works would be recorded according to HAER standards. The photographic documentation was conducted at the time of the reservoir drawdown in September, 1989. This study is intended to complete the HAER documentation.

Historian: Christine Pfaff, Bureau of Reclamation, with input from Mike Andrews, archaeologist, Bureau of Reclamation.

June 1995

## II. HISTORY

Set high in the Colorado Rockies, thirteen miles southwest of Leadville and close to the Continental Divide, the sparkling waters of Twin Lakes have almost as much to do with the eastern plains of Colorado as they do with the majestic mountains surrounding them. Ninety years ago, the potential of capturing the waters of Twin Lakes and eventually distributing them through canals and ditches to farmers in the lower Arkansas River Valley was realized with the completion of the Twin Lakes Dam. Up until 1980 when a new and higher dam was built close by downstream, the original Twin Lakes Dam played a significant role in the irrigation history of Colorado.

Completed in 1900 by the Twin Lakes Reservoir Company, the Twin Lakes dam and outlet works were part of an extensive irrigation system whose origins date back to 1889. In that year, the Colorado Land and Canal Company was formed for the purpose of building a canal to irrigate farmland in Crowley County (part of Otero County up until 1911) on the eastern plains of Colorado.<sup>1</sup>

Due to the arid conditions that existed in the Arkansas Valley east of Pueblo, early farming efforts were concentrated close to water sources along streams or the Arkansas River. Agriculture on the uplands was not feasible without irrigation and this was costly. Attempts at irrigation up until the 1880's were small scale and limited to individuals, or in some cases upon cooperating neighbors.

The plans of the Colorado Land and Canal Company were to divert water from the Arkansas River at or near the junction of Boone Creek, east of Pueblo. Most of the property under the proposed canal had been in the ownership of the State of Colorado up until 1889. A statute passed that year by the Colorado legislature authorized the sale and irrigation of these lands.<sup>2</sup>

The following year another company was formed with the same intent of bidding on the state-owned lands for the construction of an irrigation canal. Known as the Colorado Land and Water Company (CLWC), this group of investors, principally from Buffalo, NY, was successful in its venture. In July 1891, they completed the approximately fifty mile long Colorado Canal at a cost of \$400,000.<sup>3</sup> The canal, still in use today, begins at a headgate on the Arkansas River at Boone and extends along the north side of the river. Water from the canal is diverted into lateral ditches which then carry water to individual farmers.

With the availability of irrigation water from the newly completed canal, agriculture in Crowley County began to flourish. North of the canal, grazing and ranching predominated. On the south side, irrigated farming prevailed. Plum, apple and cherry orchards thrived, the fruits of which were in demand throughout the state. Crops raised included sugar beets, onions, cantaloupes, and commercial vegetables.<sup>4</sup> With the increased opportunities for agriculture, the population also began to grow.

Several months after the completion of the Colorado Canal, the CLWC secured all of the supposed rights of its unsuccessful competitor, the Colorado Land and Canal Company. The CLWC proceeded to sell land and individual eighty acre water rights to farmers under the canal. Water rights were transferred with water deeds that contained certain restrictions.<sup>5</sup>

Sometime around 1896, another corporation was formed which secured all of the rights of the CLWC and continued to sell land and water rights. This new corporation, the Twin Lakes Land and Water Company, was officially incorporated on May 24, 1898 for a twenty year term at the end of which a twenty year extension was granted.<sup>6</sup>

In 1897, yet another corporation was formed with an interest in the Crowley County irrigation system. This new entity, the Twin Lakes Reservoir Company (TLRC), was a mutual nonprofit reservoir company formed by the same group of investors who owned the Colorado Canal.<sup>7</sup> A board of directors consisted of the five individuals who formed the company : Henry Koons, James A. Roberts, Andrew Cant, W.L. Hartman and E.C. Graham. It is known that at least two of these men had been involved in the Colorado Land and Water Company which had been succeeded by, and apparently reorganized as, the Twin Lakes Land and Water Company.<sup>8</sup>

Henry Koons, of New York, had been the president of the Colorado Land and Water Company which constructed the Colorado Canal. James Roberts, also of New York and head of the New York State Land Board, was the vice-president of the Colorado Land and Water Company.<sup>9</sup> Principal offices of the Twin Lakes Reservoir Company were established in Pueblo but the Articles of Incorporation allowed for an office to be opened and maintained in the City of Buffalo, New York.

On June 15, 1897, the newly formed company filed incorporation papers with the Secretary of State . The purpose of the organization as stated in the Articles of Incorporation was ..."to purchase or otherwise acquire what is commonly known as the Twin Lakes reservoir site,... together with the rights, privileges and priorities of appropriating and storing water therein for irrigation purposes; to build, construct, maintain and operate dams, ditches, headgates, spillways and all erections, appliances, and improvements that may be necessary or convenient in constructing, maintaining and operating such reservoir, and gathering and storing water therein and conducting the same to the places where the same is to be used; all for the exclusive use and benefit of the stockholders of the company,.."<sup>10</sup>

The newly created company was proposing to build a reservoir at Twin Lakes that would store water in the winter that could be transported down the Arkansas River during the dry months to the headgate of the Colorado Canal at Boone . This water would supplement the existing supply available to farmers from the canal and allow for additional acreage to be irrigated.

The site of the proposed reservoir was Twin Lakes, two large natural mountain lakes closely connected by Lake Creek. This creek, along with various other streams and drainages, flowed down from the mountains and fed into the lakes. Altogether the lakes, which normally covered about 1900 acres and were 80 feet deep, received the drainage from 387 square miles of watershed.<sup>11</sup> From the lower lake, Lake Creek emptied into the Arkansas River.

In the Articles of Incorporation, a description of the proposed project is provided. In addition to Lake Creek connecting the upper and lower lakes, a 1500 foot long canal with a headgate would be constructed joining the two bodies of water. A second canal, 3100 feet in length, would be built at the lower end of the lower lake connecting it to Lake Creek. This canal would also incorporate a headgate. The third feature described is a dam which would be "built across the present channel of said Lake Creek.." where it leaves the lower lake.<sup>12</sup>

The Twin Lakes Reservoir Company's success in acquiring the rights to Twin Lakes for a reservoir put an end to the State of Colorado's earlier hopes of doing the same. The day after Henry Koons and James Roberts filed a claim with the state engineer for Twin Lakes, an article appeared in the Rocky Mountain News with the title and heading "Twin Lakes Are Jumped. State Will Lose a Valuable Reservoir Site, Private Capital Proposes to Carry Out the Plans Originally Contemplated by the State" The State had laid claim to the lakes in the past but had allowed its title to lapse by not undertaking required improvements. Constitutional restrictions prohibited the appropriation of the funds necessary to do the work.<sup>13</sup> Thus the ideally suited reservoir site passed into private hands.

The United States Government had also shown an interest at one time in Twin Lakes as a reservoir site. A survey of the lakes had been conducted as early as 1889 by the United States Geological Survey and resulted in a plan to convert them into one large reservoir by means of a massive earth dam across the valley below the lakes.<sup>14</sup>

Having succeeded in acquiring Twin Lakes, the TLRC proceeded with their plans to build a dam and reservoir. Construction was started in the summer of 1898 and by early 1899 was well underway. A letter written in February of that year by W.R. Graham of Ordway, Colorado to the Webster City Iowa, Freeman newspaper promoted the work of the Twin Lakes Land and Water Company and the benefits of irrigation: "...so they purchased the Twin Lakes up on the mountains, and are now converting them into an immense storage reservoir to furnish water for their ditch when the river fails. This reservoir alone cost \$250,000; so that the company now has one of the best water rights in the west."<sup>15</sup>

Not all were satisfied with the progress of the project. Leadville sportsmen strongly opposed the construction of the dam and reservoir. When the Twin Lakes Reservoir Company attempted to obtain a state license from the State Game & Fish Commissioners for a private fish pond, they were turned down.<sup>16</sup> The idea of private control over a favorite fishing spot

abounding with trout incensed local citizens.

More serious objections were raised by those who owned land directly adjacent to and below the partially completed dam and headgate. This included two railroad companies, the Colorado Midland Railroad and the Denver & Rio Grande. They were dissatisfied with the design, fearing that the dam and headgate were inadequate to withstand flooding.<sup>17</sup> In response to threats of an injunction made by railroad officials, the Twin Lakes Reservoir Company hired the respected dam engineer James D. Schuyler (1849-1912) in the spring of 1899 as a consultant to conduct an investigation of the work completed to date.<sup>18</sup>

James Dix Schuyler was born in Ithaca, N.Y. on May 11, 1849. He received his higher education at Friends' College from 1863-1868. Thereafter he began his professional career as an engineer by joining a railroad surveying party in Colorado, where he was stationed from 1869-1873. He fell in love with the West and in 1873 moved to California where he was made Division Engineer of the North Pacific Coast Railroad from Ross Valley to San Rafael. In 1877 Schuyler was appointed Chief Assistant State Engineer in the State Engineering Department of California where he remained until 1882. In that position he supervised the irrigation investigations being conducted by the Department in the Central Valley. This experience led to his involvement in the design and construction of water projects throughout the west and abroad. In 1885, Schuyler was placed in charge of building the Sweetwater dam in San Diego. The successful completion of this important project assured Schuyler's rise to prominence in his profession.<sup>19</sup>

Schuyler went on to design the Hemet dam, southwest of Palm Springs, California, one of the largest dams in the country at the time. He was involved in the construction of waterworks for the cities of Denver, Colorado, Ogden, Utah, and Portland, Oregon among other western places. In addition, he was appointed to the second Commission of Consulting Engineers by President Roosevelt to evaluate the feasibility of structures related to the Panama Canal. Schuyler also served as consulting engineer to the Territorial Government of Hawaii on the construction of the Nuuanu dam; to the Monterey Water-works and Sewer Company, Limited, of Mexico; to the Kobe Syndicate on an extensive power project in Japan involving a very large dam; to the Mexican Light and Power Company, Limited, on the building of four large dams for power development in Mexico; and to the Vancouver Power Company, Limited, on the construction of a dam at Coquitlam Lake.<sup>20</sup>

Schuyler spent four or five days at the Twin Lakes site in April 1899 along with the newly appointed chief engineer, O.O. McReynolds. At the conclusion of his visit, Schuyler submitted a report to the Twin Lakes Reservoir Company in which he recommended substantial modifications to the reservoir design. He felt that it was not only unnecessarily expensive, but also unsound.<sup>21</sup> Work completed to that time included excavating a 2000 foot long canal outside the creek channel at the lower end of the lake, laying a substantial concrete foundation in the deepest part of the canal for the headworks, and partially

completing one of the abutment walls. While Schuyler found the foundation to be more than adequate, he was particularly concerned about the design of the gates and abutment walls. He felt that the side walls of the gate chamber were not strong enough to withstand the pressure exerted by the saturated earth embankments on either side. The result could be failure of the gates.<sup>22</sup>

Schuyler proposed that rather than try to remedy the existing weak design, an entire change of plan could be accomplished without additional cost, in fact at less expense. With his report he submitted plans reflecting his revised proposal. He wrote, "I am sure they will appeal to anyone who sees them as having the appearance of greater stability than the present design, and this is a feature which should not be disregarded, for if a design appears weak it is always regarded with suspicion, but if it not only is strong but looks impregnable it will always make a better impression and be spoken of generally as a work which will last for all time".<sup>23</sup>

The changes that Schuyler recommended were adopted and the dam and outlet works as constructed reflected his design. Four large semicircular concrete culverts were built on top of the already constructed concrete foundation. The culverts extended from the line of the gates to the lower edge of the concrete foundation, a distance of forty-seven feet. Each culvert was seven feet eleven inches wide and seven feet high. Above the culverts a massive masonry dam was built across the canal. The dam, which had a height of thirty feet above the floor of the structure, was fifteen feet wide at the base and four feet wide at the top. It was constructed of sandstone ashlar, laid in large blocks and grouted with portland cement.<sup>24</sup> Extending the dam across the top of the culverts created a much stronger structure with more resistance to water pressure. In Schuyler's words, "Thus, instead of an open canal with nothing to hold the water in check but the gates, we will have a massive dam of masonry and earth, with passages underneath ample in capacity to carry the water desired to be drawn from the reservoir."<sup>25</sup>

At the downstream side of the dam, a sloped embankment of earth was built over the culverts. On Schuyler's recommendation, the fine silt found at the site was used as fill material. The embankment had a riprap stone facing which terminated against a low wall forming the facade for the culverts. The outside face of the culverts was finished with finely laid stone blocks. For a length of fifty feet above and seventy-five feet below the concrete foundation, the canal was paved with concrete. Thick walls of concrete were built along the sides of the canal to prevent erosion.<sup>26</sup>

The headworks consisted of twelve steel gates, each two feet eight and a half inches wide, and five feet high. They were installed to slide vertically between twelve inch I-beams that were embedded in the concrete foundation. Flashboards could be placed on top of the gates to raise their height.<sup>27</sup> When Schuyler arrived at the site, he found that the iron work for the gates had been handled carelessly and as "though it were a scrap heap of waste material".<sup>28</sup> The material was usable but with certain corrections to the original design. Schuyler

recommended changes to the hoisting mechanism which were incorporated.

Schuyler's plan allowed for the construction of a simple, rectangular plan ten-foot by fifty-foot gatehouse on top of the dam to protect the gate mechanism and gate keeper from the weather and "meddlesome people".<sup>29</sup> The width of the dam's earth embankment also allowed for a roadway to be included.

Schuyler also addressed the issue of a fish ladder in his report. As originally planned, fish passage was to be over the gates but Schuyler found this unsatisfactory and recommended a permanent fish ladder over and around the dam to be supplied with water from a pipe line from adjacent mountain streams. Apparently, the fish ladder was never constructed. With the adoption of Schuyler's plan, work continued on the dam and outlet works and in 1900 the project was finished at a cost of about \$200,000.<sup>30</sup>

The Twin Lakes Reservoir Company and Twin Lakes Land and Water Company continued to exist separately until 1913. At some time prior to that year, landowners under the Colorado Canal filed a suit against the latter to prevent them from selling more water rights than the canal could carry. The outcome was a compromise reached in 1913. It resulted in the Twin Lakes Reservoir Company's reorganization as the Twin Lakes Reservoir and Canal Company. This new company, which still exists today, was formed to take over and operate the entire irrigation system. The Twin Lakes Land and Water Company was left owning only its remaining land under the canal and some water rights which it had not yet been able to sell. Eventually the TLLWC sold both the land and water rights and was dissolved.<sup>31</sup>

Following the 1913 settlement, the Twin Lakes Reservoir and Canal Company owned the entire irrigation system including the Colorado Canal, all headgates and other irrigation facilities, as well as Twin Lakes Reservoir. The Twin Lakes Reservoir had a decreed storage capacity of 54,452 acre-feet.<sup>32</sup> The Company also owned certain water rights to the Arkansas River. That same year, the corporate offices of the Twin Lakes Reservoir and Canal Company were moved from Pueblo to Ordway.<sup>33</sup>

The Twin Lakes Reservoir and Canal Company greatly increased the amount of water available to farmers in the Arkansas Valley with the completion of an ambitious transmountain diversion system in 1935. Still in use today, the system collects the headwaters of the Roaring Fork River and a number of other west slope streams and carries them under the Continental Divide to the east slope through a three-mile-long tunnel known as the Independence Pass Tunnel.<sup>34</sup> As initially planned, water was discharged into the Twin Lakes Reservoir where it was stored for passage down the Arkansas River to the headgate at Boone. The project, which was considered highly successful, more than doubled the amount of water being diverted to the Arkansas River. Between 1935 and 1955, it supplied an average extra 35,238 acre feet of water per year for the melon and sugar beet farms in the Arkansas Valley.<sup>35</sup> Financing for the project was provided by a Reconstruction Finance Corporation

loan.<sup>36</sup>

With completion of the transmountain diversion system, the Twin Lakes Reservoir and Canal Company owned an irrigation system that spanned the continental divide and extended to the eastern plains of Colorado. Water distributed from the Colorado Canal provided irrigation for 56,000 acres of farmland in Crowley County.<sup>37</sup>

At just about the time the Twin Lakes Reservoir and Canal Company completed the Independence Pass Tunnel, initial plans for a much larger transmountain diversion system in Colorado were being developed by a public agency, the Bureau of Reclamation. Studies for a project to divert surplus waters from the Fryingpan River and other tributaries of the Roaring Fork River on the Western Slope of the Rockies to the dry Arkansas River Valley were initiated in 1936.<sup>38</sup> For the next 25 years, further planning studies were undertaken before the Fryingpan-Arkansas project was finalized.

During that time, the Twin Lakes outlet works began to show signs of deterioration. Between November 1949 and June 1950, rehabilitation of the outlet works included pouring a new concrete floor, adding at least one foot of concrete on top of the outlet work walls, rewiring the gatehouse, and repairing the gates themselves.<sup>39</sup>

On August 16, 1962, Public Law 87-590(77 Stat. 393) was signed by President Kennedy, authorizing construction of the Frying-Pan Arkansas Project. Plans for this large and complex water storage and distribution system included six dams and reservoirs, sixteen diversion structures on the western slope and nine tunnels with a combined length of 26.7 miles. Projections showed that the project would provide water to irrigate an additional 280,600 acres in the Arkansas Valley. It would also provide water to a number of east slope municipalities including the fast growing City of Colorado Springs.<sup>40</sup>

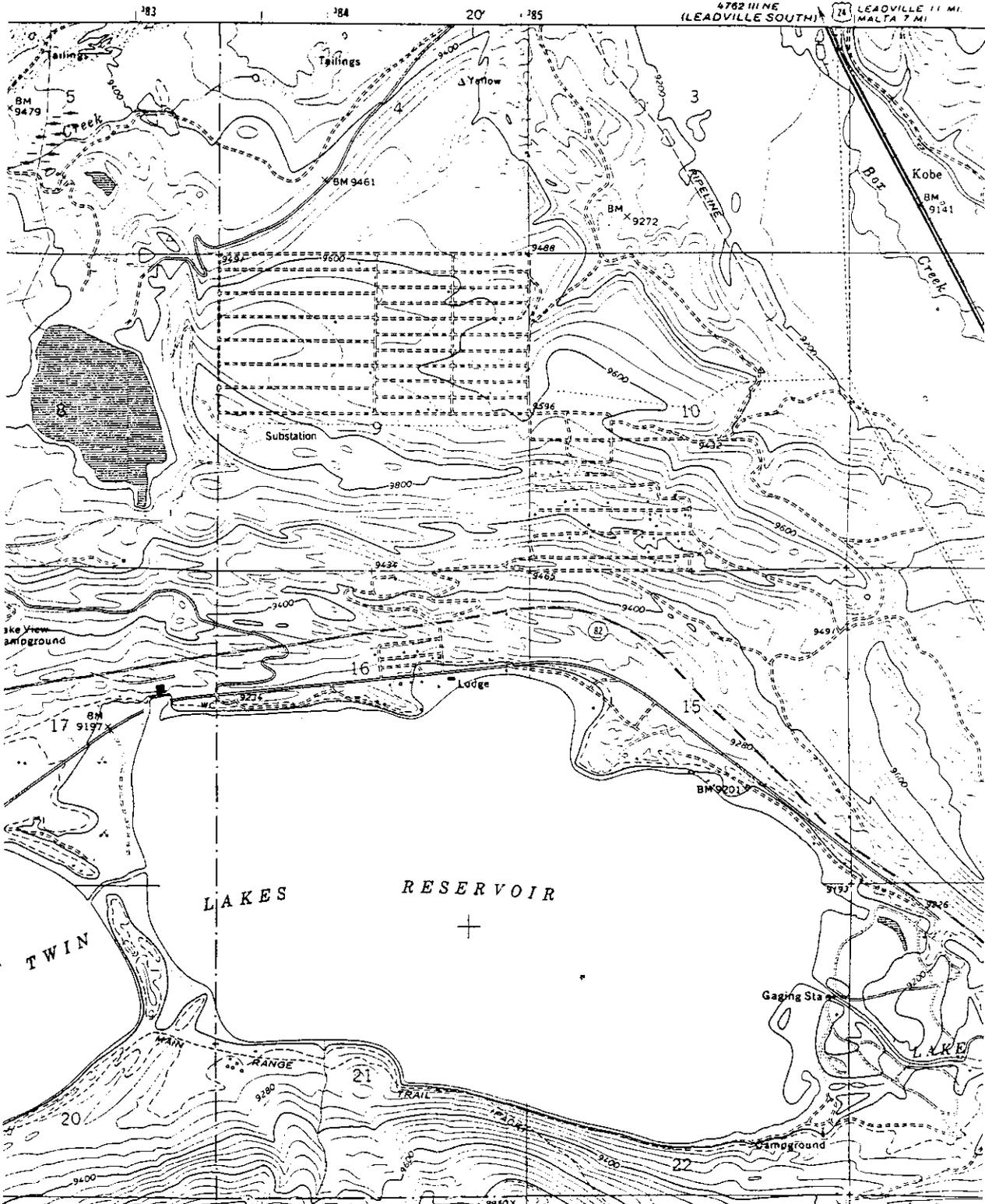
Among the reservoirs to be included in the project was an enlarged Twin Lakes. The Bureau of Reclamation formally began negotiations to purchase Twin Lakes from the Twin Lakes Reservoir and Canal Company in 1969. Eight years later, an agreement was reached and a contract for the sale of the reservoir was signed. As part of the agreement, the Twin Lakes Reservoir and Canal Company retained the rights to 54,452 acre feet of water in the enlarged reservoir.<sup>41</sup>

Enlargement of Twin Lakes by the Bureau of Reclamation to increase its capacity to 140,165 acre feet meant building a new and larger dam to replace the one already in place. Designs were developed for a zoned, earth fill structure with a height above streambed of fifty-three feet and a length of 3,150 feet. Placement of the new dam would be approximately 2,500 feet downstream from the existing one.<sup>42</sup> Construction of the new dam was completed in 1980 at which time the old dam and outlet works were inundated by the raised reservoir level.

Plans for completing the new dam originally called for removing the abandoned Twin Lakes dam outlet works structure and excavating a channel through the old Twin Lakes dam.<sup>43</sup> Due to several factors this work was not undertaken until the late 1980's. In late summer 1989, when the reservoir was lowered, the old gate structure was removed.

Today, although the Twin Lakes Reservoir and Canal Company still exists, its original purpose to provide water for farming in Crowley County has changed. The Company still owns the Independence Pass transmountain diversion system and its rights to water storage in Twin Lakes but since selling the reservoir has also divested itself of the Colorado Canal. Major stockholders in the company today are the City of Colorado Springs, City of Pueblo, Pueblo West Metropolitan District, and the City of Aurora. Where the waters from Twin Lakes Reservoir originally irrigated the croplands of the Arkansas Valley, today they primarily serve the needs of expanding front range cities. In 1994 only 6600 acres of farmland in Crowley County were being irrigated with water diverted in the Colorado Canal.<sup>44</sup>

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U.S.G.S. 7.5 Minute Series: Granite, Colorado Quadrangle



### III. DESCRIPTION OF OUTLET WORKS: SEPTEMBER 1989

The Twin Lakes dam and outlet works consist of an earthen, masonry and concrete structure built into the terminal moraine which created Twin Lakes. In plan view, the dam and outlet works is H-shaped, where the water flows into a concrete paved canal which forms the top of the "H", through the gate structure in the cross-bar, and out through the concrete-paved lower canal which forms the bottom of the "H". The cross-bar of the "H" consists of four large semi-circular concrete culverts constructed on a thick concrete foundation between parallel masonry walls. The culverts extend from the line of the gates to the lower edge of the thick concrete foundation, a distance of forty-seven feet. Above the culverts is the masonry dam covered by a large sloping earth fill embankment. Much of the dry-laid sandstone rip-rap that originally covered and contained the sloped embankment is obscured by dirt.

The gate house which originally sat on top of the dam and protected the gate structure no longer exists. Only a partial concrete foundation is visible. The slide gates are exposed--they are numbered and total twelve, with six located on either side of a masonry buttress column. The gates operated in metal slides via a gearing system on top. Nearly all of the metal used in the outlet works was steel. This includes the gates, slides, screw shafts, fasteners, building and gate supports, rivets, supports for the gatehouse floor joists, safety chains and most of the gears. The only exception noted were the main horizontal gears, which were brass. All of the metal appeared to be foundry forged; none appeared to be of local manufacture.

Two beams of rough cut lumber were present on the gate structure when it was examined. Each beam, measuring twenty inches square and approximately twenty-two feet long, rested on and was attached to the horizontal steel supports above a set of six gates. Each beam was drilled with six holes through which the threaded gate shafts passed. The beams served to support the gearing mechanism which raised and lowered the shafts. The two beams were attached to each other by two two-by-fours which spanned the gap created by the central stone buttress. Nailed to the wood beams were miscellaneous two-by-fours whose purpose was unknown.

Masonry wing walls extend upstream from the gate structure for about twenty-three feet and then make a right angle to join the sloped canal embankment walls. The uppermost sections of the wing walls are concrete which was added in 1949-50.

The outflow end of the structure is much lower in profile than the intake side. The concrete culverts terminate in a finely laid masonry wall with four arched openings. The top of the masonry wall is finished with two courses of stone above which is a short concrete retaining wall no doubt added during the 1949-50 rehabilitation. Masonry wing walls topped with concrete (1949-50 addition) extend downstream from the culvert headwall and make a right angle turn into the bank of the channel. Beyond this corner is a sloped concrete apron on each side.

The masonry walls on both the intake and outtake sides of the outlet works consist of evenly coursed, shaped and faced sandstone with large amounts of mortar. The mortar exhibited undoubtedly was added during the rehabilitation project of 1949-50 when the stone faces of the structure were tuckpointed.

The total length of the structure from the corner of the intake wing wall to the corner of the downstream wing wall is about 150 feet. The height of the structure at the upstream side is thirty-two feet from the floor of the intake canal to the top of the concrete footing for the gate house. At the downstream side, the height is thirteen feet from the floor of the outlet canal to the top of the masonry culvert headwall.

#### IV. ENDNOTES

1. Holland & Hart, Attorneys at Law. "Memorandum Prepared for the Twin Lakes Reservoir and Canal Company, Part I", January 1, 1956. (Typewritten): p. 2.
2. Holland & Hart, Attorneys at Law. "Memorandum Prepared for the Twin Lakes Reservoir and Canal Company, Part I", January 1, 1956. (Typewritten): p. 2.
3. Letter from W.R. Graham to the Webster City Iowa, Freeman written from Ordway, Colorado, February 6, 1899. (Property of Twin Lakes Reservoir and Canal Company): p. 2.
4. Crowley County Heritage Society. The History of Crowley County. Dallas: Taylor Publishing Co., 1980; 6.
5. Holland & Hart, Attorneys at Law. "Memorandum Prepared for the Twin Lakes Reservoir and Canal Company, Part I", January 1, 1956. (Typewritten):p. 5.
6. Holland & Hart, Attorneys at Law. "Memorandum Prepared for the Twin Lakes Reservoir and Canal Company, Part I", January 1, 1956. (Typewritten): p. 6.
7. Holland & Hart, Attorneys at Law. "Memorandum Prepared for the Twin Lakes Reservoir and Canal Company, Part I", January 1, 1956. (Typewritten):p. 6.
8. "Twin Lakes Are Jumped." Rocky Mountain News (January 9, 1897): p.8, c.1.
9. "Twin Lakes Are Jumped." Rocky Mountain News (January 9, 1897): p.8, c.1.
10. "Articles of Incorporation of the Twin Lakes Reservoir Company", June 14, 1897. p.1.
11. Schuyler, James Dix. Reservoirs for Irrigation, Water-Power and Domestic Water-Supply. New York: John Wiley & Sons, 1908. : p. 484.
12. "Articles of Incorporation of the Twin Lakes Reservoir Company", June 14, 1897.: p. 4.
13. "Probably Largest Natural Bodies of Water in Mountains; Claimed by State Which Permitted Title to Lapse and Private Capital Takes Advantage." Denver Times (December 31, 1898): p.14, c.6.
14. Schuyler, James Dix. Reservoirs for Irrigation, Water-Power and Domestic Water-Supply. New York: John Wiley & Sons, 1908.: p. 484.
15. Letter from W.R. Graham to the Webster City Iowa, Freeman written from Ordway, Colorado, February 6, 1899. (Property of Twin Lakes Reservoir and Canal Company): p. 1.

16. "Object to the Twin Lakes Dam." Denver Times (July 31, 1899): p.1, c.5.
17. "Fixing the Dam." Denver Times (April 30, 1899): p.3, c.3.
18. Schuyler, James Dix. Reservoirs for Irrigation, Water-Power and Domestic Water-Supply. New York: John Wiley & Sons, 1908. p. 485.
19. "Memoir of James Dix Schuyler." Transactions of the American Society of Civil Engineers. Vol. LXXVI (December, 1913): p. 2243.
20. "Memoir of James Dix Schuyler." Transactions of the American Society of Civil Engineers. Vol. LXXVI (December, 1913): p. 2243.
21. Schuyler, James D. "Report on the Outlet Gates of the Twin Lakes Reservoir, With Proposed Changes of Plan", Pueblo, Colorado, April 27, 1899. (Typewritten copy property of Twin Lakes Reservoir and Canal Company): p.1.
22. Schuyler, James D. "Report on the Outlet Gates of the Twin Lakes Reservoir. With Proposed Changes of Plan", Pueblo, Colorado, April 27, 1899. (Typewritten copy property of Twin Lakes Reservoir and Canal Company): p. 2.
23. Schuyler, James D. "Report on the Outlet Gates of the Twin Lakes Reservoir, With Proposed Changes of Plan", Pueblo, Colorado, April 27, 1899. (Typewritten copy property of Twin Lakes Reservoir and Canal Company): p. 3.
24. Schuyler, James Dix. Reservoirs for Irrigation, Water-Power and Domestic Water-Supply. New York: John Wiley & Sons, 1908.: p. 487.
25. Schuyler, James D. "Report on the Outlet Gates of the Twin Lakes Reservoir, With Proposed Changes of Plan", Pueblo, Colorado, April 27, 1899. (Typewritten copy property of Twin Lakes Reservoir and Canal Company): p. 3.
26. Schuyler, James Dix. Reservoirs for Irrigation, Water-Power and Domestic Water-Supply. New York: John Wiley & Sons, 1908.: p. 487.
27. Schuyler, James Dix. Reservoirs for Irrigation, Water-Power and Domestic Water-Supply. New York: John Wiley & Sons, 1908.: p. 485.
28. Schuyler, James D. "Report on the Outlet Gates of the Twin Lakes Reservoir, With Proposed Changes of Plan", Pueblo, Colorado, April 27, 1899. (Typewritten copy property of Twin Lakes Reservoir and Canal Company):p. 6.

29. Schuyler, James D. "Report on the Outlet Gates of the Twin Lakes Reservoir, With Proposed Changes of Plan", Pueblo, Colorado, April 27, 1899. (Typewritten copy property of Twin Lakes Reservoir and Canal Company): p. 5.
30. Schuyler, James D. "Report on the Outlet Gates of the Twin Lakes Reservoir, With Proposed Changes of Plan", Pueblo, Colorado, April 27, 1899. (Typewritten copy property of Twin Lakes Reservoir and Canal Company) : p. 5.
31. Holland & Hart, Attorneys at Law. "Memorandum Prepared for the Twin Lakes Reservoir and Canal Company, Part I", January 1, 1956. (Typewritten) p.8.
32. Holland & Hart, Attorneys at Law. "Memorandum Prepared for the Twin Lakes Reservoir and Canal Company, Part I", January 1, 1956. (Typewritten):p. 21.
33. "Amendments to Articles of Incorporation of the Twin Lakes Reservoir Company", November 10, 1913.
34. Bancroft, George. "Diversion of Water from the Western Slope". Colorado Magazine. Vol. XXI (September, 1944): p. 181.
35. Holland & Hart, Attorneys at Law. "Memorandum Prepared for the Twin Lakes Reservoir and Canal Company, Part I", January 1, 1956. (Typewritten):p. 21.
36. Cole, Donald. "Transmountain Water Diversion in Colorado". Colorado Magazine. Vol. XXV (March, 1948) : p. 59.
37. Holland & Hart, Attorneys at Law. "Memorandum Prepared for the Twin Lakes Reservoir and Canal Company, Part I", January 1, 1956. (Typewritten): p. 23.
38. U.S. Department of the Interior. Water and Power Resources Service. Project Data. Denver: Government Printing Office, 1981.: p. 491.
39. Doe, Wallace. "Sequence of Operations During Rehabilitation of Twin Lakes Reservoir Outlet Works, Nov. 1949 to June 1950", December, 1950.: pp. 1-3.
40. U.S. Department of the Interior. Water and Power Resources Service. Project Data. Denver: Government Printing Office, 1981. : p. 485.
41. "Annual Reports of the Officers of the Twin Lakes Reservoir and Canal Company", Ordway, Colorado, 1977.: p. 4.
42. U.S. Department of the Interior. Bureau of Reclamation. Final Environmental Impact Statement for Fryingpan-Arkansas Project. 1975.

43. U.S. Department of the Interior. Bureau of Reclamation. Final Environmental Assessment for Removal Of Existing Dikes and Abandoned Outlet Works At Twin Lakes Dam. June 19, 1989.: p. 1.

44. Conversation with Allen Ringle, Superintendent of Colorado Canal Company, Ordway, Colorado, June 5, 1990.

## V. BIBLIOGRAPHY

### A. Books

Crowley County Heritage Society. The History of Crowley County. Dallas: Taylor Publishing Company, 1980.

Schuyler, James Dix. Reservoirs for Irrigation. Water-Power and Domestic Water-Supply. New York: John Wiley & Sons, 1908.

### B. Articles, Other Papers and Interviews

"Amendments to Articles of Incorporation of the Twin Lakes Reservoir Company", November 10, 1913.

"Annual Reports of the Officers of the Twin Lakes Reservoir and Canal Company", Ordway, Colorado, 1969.

"Annual Reports of the Officers of the Twin Lakes Reservoir and Canal Company", Ordway, Colorado, 1975.

"Annual Reports of the Officers of the Twin Lakes Reservoir and Canal Company", Ordway, Colorado, 1976.

"Annual Reports of the Officers of the Twin Lakes Reservoir and Canal Company", Ordway, Colorado, 1977.

"Articles of Incorporation of the Twin Lakes Reservoir Company", June 14, 1897.

Bancroft, George. "Diversion of Water from the Western Slope". Colorado Magazine. Vol. XXI (September, 1944): 181.

Cole, Donald. "Transmountain Water Diversion in Colorado". Colorado Magazine. Vol. XXV (March, 1948): 57,59.

Conversation with Frances Mumm, Twin Lakes Reservoir and Canal Company, Ordway, Colorado, June 5, 1990.

Conversation with Allen Ringle, Superintendent of Colorado Canal Company, Ordway, Colorado, October, 1994.

Doe, Wallace. "Sequence of Operations During Rehabilitation of Twin Lakes Reservoir Outlet Works, Nov. 1949 to June 1950", December, 1950.

"Fixing the Dam." Denver Times (April 30, 1899): p.3, c.3.

Holland & Hart, Attorneys at Law. "Memorandum Prepared for the Twin Lakes Reservoir and Canal Company, Part I", January 1, 1956. (Typewritten)

"In the Irrigation World." Denver Times (December 31, 1899): p.6, c.1.

Letter from W.R. Graham to the Webster City Iowa, Freeman written from Ordway, Colorado, February 6, 1899. (Property of Twin Lakes Reservoir and Canal Company)

"Memoir of James Dix Schuyler." Transactions of the American Society of Civil Engineers. Vol. LXXVI (December, 1913): p. 2243.

"Object to the Twin Lakes Dam." Denver Times (July 31, 1899): p.1, c.5.

"Plan of Dam and Head Gates for the Twin Lakes Reservoir at Twin Lakes, Lake County, Colorado" James D. Schuyler, Consulting Engineer, O.O. McReynolds, Chief Engineer. July 17, 1899. (Property of Twin Lakes Reservoir and Canal Company)

"Probably Largest Natural Bodies of Water in Mountains; Claimed by State Which Permitted Title to Lapse and Private Capital Takes Advantage." Denver Times (December 31, 1898): p.14, c.6.

Schuyler, James D. "Report on the Outlet Gates of the Twin Lakes Reservoir, With Proposed Changes of Plan", Pueblo, Colorado, April 27, 1899. (Typewritten copy property of Twin Lakes Reservoir and Canal Company)

"Twin Lakes Are Jumped." Rocky Mountain News (January 9, 1897): p.8, c.1.

"Van Hook, Joseph. "Development of Irrigation in the Arkansas Valley." Colorado Magazine. Vol. X.(January,1933): 3-11.

"Will Dam Twin Lakes." Rocky Mountain News (January 21, 1897): p.5, c.3.

### **C. United States Government Documents**

U.S. Department of the Interior. Bureau of Reclamation. Final Environmental Assessment for Removal Of Existing Dikes and Abandoned Outlet Works At Twin Lakes Dam. June 19, 1989.

U.S. Department of the Interior. Bureau of Reclamation. Final Environmental Impact Statement for Fryingpan-Arkansas Project. 1975.

U.S. Department of the Interior. Water and Power Resources Service. Project Data. Denver: Government Printing Office, 1981. pp 485-505.