United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations of eligibility for individual properties or districts. See instructions in *Guidelines for Completing National Register Forms* (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. If an item does not apply to the property being documented, enter "NA" for "not applicable." For functions, styles, materials, and areas of significance, enter only the categories and subcategories listed in the instructions. For additional space use continuation sheets (Form 10-900a). Type all entries.

1. Name of Property

historic name: CARLSBAD IRRIGATION DISTRICT
other names/site number: Carlsbad Project; Irrigation System of the Pecos Irrigation and Improvement Company

2. Location

street & number: [ ] not for publication
city, town: Carlsbad [XX] vicinity
state: New Mexico code: NM County: Eddy code: 015 zip code: 88220

3. Classification

Ownership of Property
[XX] private
[ ] public - local
[ ] public - State
[XX] public - Federal

Category of Property
[ ] building(s)
[XX] district
[ ] site
[ ] structure
[ ] object

Number of Resources within Property

Contributing	Noncontributing	
7	1	buildings
		sites
22		structures
		objects
29	1	Total

Name of related multiple property listing: none

Number of contributing resources previously listed in the National Register 1

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this [XX] nomination [ ] request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property [ ] meets [ ] does not meet the National Register Criteria [ ] See continuation sheet.

Signature of certifying official Date

State or federal agency and bureau

In my opinion, the property [ ] meets [ ] does not meet the National Register Criteria [ ] See continuation sheet.

Signature of commenting or other official Date

State or federal agency and bureau

5. National Park Service Certification

I, hereby, certify that this property is:
|__| entered in the National Register.
 |__| See continuation sheet.
|__| determined eligible for the National Register. |__| See continuation sheet.
|__| determined not eligible for the National Register
|__| removed from the National Register.
|✓| other: NHL Boundary Study

Carol D Shull — Signature of the Keeper

2-28-96 — Date of Action

6. Function or Use

Historic Functions (enter categories from instructions)	Current Functions (enter categories from instructions)
AGRICULTURE/SUBSISTENCE: Irrigation facility	AGRICULTURE/SUBSISTENCE: Irrigation facility
DOMESTIC: Single dwelling	DOMESTIC: Single dwelling
COMMERCE/TRADE: Financial institution	COMMERCE/TRADE: Financial institution

7. Description

Architectural Classification (enter categories from instructions)	Materials (enter categories from instructions)
Other: Rockfill dam	Earth/Concrete
Other: Irrigation canal system	Earth/Concrete
Other: Reinforced concrete flume	Concrete
Other: Inverted siphon	Concrete
Other: vernacular	Stone/Stucco
Italianate	Brick/Metal

The Carlsbad Irrigation District is a reclamation system located in the Pecos River Valley of southeastern New Mexico, near the community of Carlsbad (named "Eddy" until 1899). The region displays only moderate variations in topography, with generally flat prairies cut by shallow canyons and arroyos. Water in the smaller canyons flows intermittently, depending on the season, and flash floods are not uncommon. The Pecos River is the area's primary watercourse; it flows southward through eastern New Mexico and into Texas, where it eventually joins the Rio Grande. The Pecos Valley is generally arid and warm, with deep, sandy-loam soils. As an agricultural area, the benefits of the region's long growing season are counteracted by inadequate and unpredictable rainfall.

Many of the Irrigation District's physical features were constructed by private entrepreneurs during the late 1800s and early 1900s. The United States Reclamation Service purchased the system after the private effort failed in 1904. Title to the District's irrigation system remains vested in the federal government. The First National Bank of Eddy in downtown Carlsbad is owned by the Carlsbad Irrigation District, the water users' group that has controlled the day-to-day operations of the system since 1949.

XX See continuation sheet

8. Statement of Significance

Certifying official has considered the significance of this property in relation to other properties:
|XX| nationally |__| statewide |__| locally

Applicable National Register criteria: |XX| A |__| B |XX| C |__| D

Criteria Considerations (Exceptions): |__| A |__| B |__| C |__| D |__| E |__| F |__| G

Areas of Significance (enter categories from instructions)	Period of Significance	Significant Dates	
		1888	1905
Agriculture	1888-1949	1889	1907
Engineering		1893	1911
		1903	1949

Cultural Affiliation

N/A

Significant Person

N/A

Architect/Builder

Cloud, H.H.; Blauvelt, Louis D.; Nettleton, Edwin S.; Hall, B.M.; Teichman, Frank; and others

The extensive system of dams, reservoirs, and irrigation canals operated today as the Carlsbad Irrigation District is nationally significant under National Historic Landmark (NHL) criteria "1" and "4." As an excellent representation of the historical evolution of western American reclamation activity and policy, the District achieves significance under NHL criterion "1," which recognizes properties that "outstandingly represent . . . the broad national patterns of United States history." The physical plant constructed as part of the reclamation enterprise was both complex and technically sophisticated for its day, employing techniques which proved highly significant in the development of American reclamation engineering. As such, the District is significant under NHL criterion "4," as a property "exceptionally valuable for a period, style, or method of construction . . ."[1]

The Carlsbad Irrigation District is representative of NHL Theme XI ("Agriculture"), Subtheme E ("Agriculture as a Business Enterprise Beyond Self-Sufficiency, 1820-"). The District includes exceptionally strong visual reminders of an unusually large and complex nineteenth-century irrigation network, including two major structures (McMillan Dam and the Pecos River Flume) which exhibit design qualities of national significance. Surviving canals and other supplementary features further enhance the depiction of a nineteenth-century reclamation system. Superimposed upon these vintage irrigation works are a series of federally-constructed features which are highly representative of the early technical innovation and experimentation of the United States Reclamation Service. Avalon Dam, the most significant of these features, includes pioneering examples of engineering techniques which saw significant later use in major Reclamation Service projects.

In addition to the Project's well-preserved examples of early reclamation engineering and design, the Project is a significant representation of the historical progression of western reclamation practice. It is perhaps the West's finest illustration of the evolution from nineteenth-century irrigation attempts predicated on the efforts of private entrepreneurs, to the relatively expansive,

XX See continuation sheet

9. Major Bibliographical References

|XX| See continuation sheet

Previous documentation on file (NPS):
|__| preliminary determination of individual listing (36 CFR 67) has been requested
|__| previously listed in the National Register
|__| previously determined eligible by the National Register
|XX| designated a National Historic Landmark
|__| recorded by Historic American Buildings Survey # ____________
|XX| recorded by Historic American Engineering Record # HAER No. NM-4

Primary location of additional data:
|__| State historic preservation office
|__| Other State Agency
|XX| Federal Agency
|__| Local government
|__| University
|__| Other
Specify repository: ____________

10. Geographical Data

Acreage of property 5,464 acres

UTM References

A |_|_| |_|_|_|_|_|_| |_|_|_|_|_|_|_| B |_|_| |_|_|_|_|_|_| |_|_|_|_|_|_|_|
Zone Easting Northing Zone Easting Northing
C |_|_| |_|_|_|_|_|_| |_|_|_|_|_|_|_| D |_|_| |_|_|_|_|_|_| |_|_|_|_|_|_|_|

|XX| See continuation sheet

Verbal Boundary Description

|XX| See Continuation Sheet

Boundary Justification

|XX| See Continuation Sheet

11. Form Prepared by

name/title Mark Hufstetler, Historian, and Lon Johnson, Historical Architect
organization Renewable Technologies, Inc. date August 1, 1991
street & number 511 Metals Bank Building telephone (406) 782-0494 city or town Butte state Montana zip code 59701

Today, the infrastructure of the Carlsbad Irrigation District provides irrigation water to approximately 25,000 acres of farmland in the Carlsbad area and along the valley to the south. Historically, this water was provided through a reclamation system which included Avalon Dam and Reservoir, McMillan Dam and Reservoir, two primary canals and a substantial network of laterals. McMillan was the farthest upstream of these features, and served as a storage reservoir for the network. Water released from McMillan traveled downstream to Avalon Reservoir, which was primarily a water diversion facility. Headgates at Avalon accessed the system's main canal, which led southward, roughly paralleling the river channel. Three miles below Avalon, the canal divided into two canals; these canals, in turn, supplied water to a complex network of smaller, lateral and sub-lateral canals leading to the irrigated fields. The complete system was managed from a suite of offices in the First National Bank of Eddy.

Although much of this historic pattern of operation remains intact and operating today, two significant changes have taken place. In 1938 water storage at the two historic reservoirs was supplemented by the construction of Alamogordo (now Fort Sumner) Dam and Reservoir, some 160 miles upstream from Carlsbad. The system was further changed in 1988 with the completion of Brantley Dam, located approximately midway between McMillan and Avalon. Neither the facilities at Brantley nor Alamogordo are considered in this nomination. Brantley was constructed well outside the District's period of significance; Alamogordo is excluded due to its extreme physical separation from the remainder of the project, and because it was not a part of the reclamation project as historically envisioned.

The historic canal network, along with the facilities at Avalon and McMillan, was designated a National Historic Landmark in 1975, under the name "Carlsbad Reclamation Project." This document is a revision of the 1975 nomination, intended to provide additional descriptive and historical information, as well as a more clearly-defined district boundary. The name "Carlsbad Reclamation Project" in the earlier document utilized descriptive terms employed by the Reclamation Service; the replacement name was chosen as more representative of both the private and the public phases of the reclamation system's history.

In addition to the primary features described above, the reclamation system includes several other significant structures and support buildings. Each of the major resources within the historic district is listed below; subsequent paragraphs describe each of these features in more detail.

1) McMillan Dam and Reservoir (structure)
2) McMillan Spillway No. 1 (structure)
3) McMillan Spillway No. 2 (structure)
4) McMillan West Embankment (structure)
5) McMillan East Embankment (structure)
6) McMillan Railroad Dike (structure)

7) McMillan Gate Keeper's House (building)
8) McMillan garage/boathouse (building)
9) Avalon Dam and Reservoir (structure)
10) Avalon Spillway No. 1 (structure)
11) Avalon Spillway No. 2 (structure)
12) Avalon Spillway No. 3 (structure)
13) Avalon suspension bridge (structure)
14) Avalon water distribution system (structure)
15) Avalon Gate Keeper's House (building)
16) Avalon garage (building)
17) Avalon warehouse (building)
18) Avalon guard house (building)
19) Avalon storage building (building)
20) "Main" or "Southwest" canal (structure)
21) Canal bifurcation works (structure)
22) Canal Wasteway No. 2 (structure)
23) Canal Wasteway No. 3 (structure)
24) "East Side" canal (structure)
25) Pecos River flume (structure)
26) Dark Canyon Siphon (structure)
27) Black River Supply Ditch (structure)
28) Black River Diversion Dam (structure)
29) Black River Ditch (structure)
30) First National Bank of Eddy (building)

With the exception of the Avalon storage building (Feature #19), all of the above buildings and structures are contributing properties.

1) MCMILLAN DAM AND RESERVOIR

McMillan Dam (also historically known as "Seven Rivers Dam" and "Reservoir No. 1") is located on the Pecos River about 13 miles north north-west of Carlsbad. The dam intercepts the entire flow of the Pecos River at a location where limestone bluffs converge to narrow the Valley width. The dam was constructed in 1893 by the Pecos Irrigation and Improvement Company as part of a grandiose plan to irrigate hundreds of thousands of acres in the Pecos Valley. Its design and construction was carried out under the supervision of chief engineer Louis D. Blauvelt.[1]

The reservoir created by McMillan Dam (known as Lake McMillan) was historically the main storage reservoir for the Carlsbad Irrigation District. On the facility's completion, the Engineering Record proclaimed Lake McMillan to be "probably the largest artificial reservoir in America and . . . one of the greatest in the world."[2] This title, however, was based on a reservoir capacity of 138,000 acre-feet, while an 1895 survey of the reservoir listed its capacity at only 82,644 acre-feet. Nevertheless, based on the figures given in the 1894 article, McMillan Reservoir still ranked second in size in the United States (only the Helmet Valley, California reservoir ranked larger) and fourth in size in the world.[3]

McMillan Dam is a rockfill dam faced with a layer of impervious earth. As originally built, it had an maximum height of 55 feet at an elevation of 3276.6 feet. The total crest width was 20 feet, and total crest length was 1686 feet. The rockfill portion had a crest width of 14 feet with a downstream width to height slope of 1.5:1 and an inside slope of hand-laid stone, 2 feet thick, with a slope of 0.5:1. The earth facing placed against the inside slope of the rockfill had a crest width of 6 feet with an upstream slope of 3.5:1. Total width at the base of the dam was 290 feet.

After a flood in 1911, the Reclamation Service found it "expedient" to raise McMillan Dam 3 feet. Reclamation Service crews constructed a hand-laid rock wall with a slope of 0.5:1 against the face of the dam. They then raised the dam to the top of the wall with compacted, wetted earth. Additional Reclamation Service work occurred after a 1915 flood caused a leak which threatened McMillan's collapse. On the recommendation of a Reclamation Service consulting engineer, laborers dug a 13-foot deep trench across the length of the dam and filled it with puddled clay mixed with gravel.

During the winter of 1937-38, Civilian Conservation Corps (CCC) crews assisted the Bureau of Reclamation in the reconstruction of McMillan Dam to the condition that largely exists today. The crews removed the top 11 feet of the dam and replaced it with compacted earthfill, raising the crest to a new structural height of 57 feet with a crest length of 2,114 feet at an elevation of 3280 feet. A "cofferdam" constructed of waste material approximately one-half way up the upstream slope of the dam has a crest of 10 feet. This cofferdam served as a foundation for increasing the upstream slope from 3.5:1 to 2.75:1, and resulting in a widened crest of 25 feet. The crews also added a 2-foot-wide sand and gravel filter against the upper 12 feet of the dam's original hand-laid stone wall. Sewer pipe drains were laid in front of the dam's toe and covered with waste material at a slope of 3:1.

McMillan's outlet works are located at the east end of the dam and are the only controlled outlet from the reservoir. Water is discharged through a reinforced concrete headgate structure into an 1100-foot-long channel which returns to the Pecos River. The Reclamation Service constructed the current headgates during the winter of 1908-1909, replacing the dam's original wooden headgates. The 35-foot-high outlet structure has a bottom width of 29 feet sloping inward from the downstream face to a top width of 19 feet. Five 4-foot by 8-foot sluiceways passing through the base of the structure are controlled by metal sluicegates (which replaced the original wooden gates in 1915). The original hand-operated ball-bearing gate stands are now operated by a gasoline engine. A reinforced concrete slab "box" on top of the sluicegates creates a cavity filled with puddled earth and rock to provide loading to counter the upward pressure of the reservoir. Concrete sidewalls, 18 inches thick and integral with the headgate structure, serve as cut-off walls extending to the east and the west. Water is directed into the headgate structure between random-cut stone walls. A 98-foot-long concrete apron, constructed by the CCC in 1938, protects the downstream channel from undercutting the headworks structure.

A stuccoed gate house with a hipped roof is located to the east of the outlet works, actually rising from the inlet channel wall. The 21 foot, 2 inch by 9 foot, 5 inch building with a 7 foot, 11 inch by 10 foot, 8 inch addition on the southeast corner houses a gasoline engine for powering the gate operating mechanism.

A stone wall constructed by the CCC serves as a guardrail across the south side of the headgate structure and extends beyond it on both sides. The east wall turns south and extends along the top of the outlet channel, and the south wall runs beside the road that crosses the headgate structure. A second CCC stone wall begins at the west end of the gate stands and extends north and then west.

2) McMILLAN SPILLWAY NO. 1

McMillan Dam originally included three spillways; two of these survive today. Spillway No. 1, constructed in 1917, is located in a saddle approximately 2,500 feet northwest of the dam. It consists of a 1400-foot-long concrete weir placed between concrete abutments and discharges water from the reservoir at an elevation of 3267.5 feet. The weir never rises more than a few inches above the surrounding ground level, which in places was raised to the weir's appropriate elevation with rock riprapping. The spillway's discharge capacity is 22,000 cubic-feet per second. Water passing over the spillway enters a channel and discharges into the Pecos River about 1/2 mile below McMillan Dam. A 112-foot-long, 1-foot-wide, curved concrete cut-off wall is located in the channel approximately 1300 feet from the Pecos River.

3) McMILLAN SPILLWAY NO. 2

Spillway No. 2 is located approximately 1 mile northwest of McMillan Dam. The reinforced concrete "circular" spillway was constructed in 1917 and is capable of discharging 12,500 cubic-feet per second. In plan, the mouth or crest of the spillway opens to the north from which it curves to the lower cut-off in a west-southwesterly direction. The spillway was originally about 740 feet long; during the 1980s, however, the Atchison, Topeka, & Santa Fe Railway was relocated over the structure, reducing its length to 487 feet. The spillway crest is 350 feet long at an elevation of 3266.5 feet, 1 foot below the crest of Spillway No. 1. Vertical H-beams imbedded along the crest permit the installation of flashboards to raise the spillway crest to 3267.7 feet. Spillway No. 2 has a sloping concrete floor with concrete sidewalls rising 8 feet at a 1-1/8:1 slope. A 9-inch-thick concrete training wall, 5 to 6 feet high, through the center of the structure, directs the flow of water around the curve to where the spillway straightens out. The spillway discharges water into a channel which returns to the Pecos River about 2 miles below the dam.

In addition to the primary dam components described above, three other substantial embankments help define the reservoir boundary. They are described individually below:

4) McMILLAN WEST EMBANKMENT

The West Embankment begins at Spillway No. 2 and extends in a general northerly direction for 4450 feet. Portions of the embankment date from 1893, with reconstructions and additions made after the floods of 1904, 1911, and 1915. Spillway No. 3 was originally located in this embankment, but it was abandoned and filled-in in 1915. The rockfill downstream section of the embankment has a slope of 1.5:1 with an upstream earthfill section of 2.5:1. The crest varies in width from 12 to 20 feet and is at an approximate elevation of 3276 feet.

5) McMILLAN EAST EMBANKMENT

The East Embankment is located approximately 1500 feet east of McMillan Dam and extends in a northeasterly direction for 3 miles. The Reclamation Service first constructed the embankment in 1908-09 to block off large openings in the gypsum deposits along the southeastern shore of the reservoir. Reconstructions and additions to the embankment followed in 1911, 1915, 1936, and 1954. The embankment is rockfill with an upstream slope of hand-laid stone with a slope of 0.75:1 and a downstream slope of 1.5:1. The northernmost 2,100 feet, constructed in 1954, has slopes of 2:1. The crest is approximately 10 to 12 feet wide and at an elevation of 3276 feet. A concrete outlet controlled by a circular gate passes through the embankment near the southern end.

6) McMILLAN RAILROAD DIKE

The Railroad Dike is located approximately 3000 feet southwest of Spillway Number 1. It was constructed in 1917 to protect the Atchison, Topeka, & Santa Fe's railroad bed from water flowing over the spillway. The crest of the 2000-foot-long embankment is oriented in a northwest and then northerly direction. The Dike consists of an upstream rockfill section built with a 1.5:1 slope and a downstream earthfill section constructed with a 2:1 slope. Wire bags filled with rocks protect the southern 300 feet of the dike against high water velocities. A single culvert with a wooden door hinged on the top drains water from the railroad borrow pit through the dike and into the spillway channel.

7) McMILLAN GATE KEEPER'S HOUSE

To the east of the McMillan outlet works and facing each other across the dam's access road are two vernacular buildings: the McMillan gate keeper's house and a combination garage/boathouse.

The one-story, gable-roofed, L-shaped gate keeper's house was constructed c. 1896. Each gable end is 17 feet wide. Overall length of the house is 33 feet, 6 inches. The house is faced with random-coursed, quarry-faced, native limestone. A covered porch is located within the legs of the L. Many of the original piers supporting the porch roof are missing. An 8-foot-wide addition wraps around the southwest corner of the house extending 40 feet along the south side and 26 feet, 6 inches along the east side. The windows and doors have been removed by vandals. Window and door openings are topped with segmental arches. The roof is covered with corrugated steel.

8) McMILLAN GARAGE/BOATHOUSE

The stuccoed, gable-fronted garage/boathouse was constructed by CCC crews and measures 22 feet, 3 inches by 30 feet, 4 inches. Openings for an entrance door, overhead garage door, and boarded-up window are located on the south elevation. The remains of two windows are located on the west elevation and those of a garage door and a single window are located on the north elevation. The roof is covered with corrugated steel. A relatively recent 11 foot, 6 inch by 18 foot, 5 inch shed-roofed addition that was once attached to the southeast corner has been destroyed by vandals, who have also removed most of the doors and windows.

9) AVALON DAM AND RESERVOIR

Avalon Dam (also historically known as "Reservoir No. 2," "Rock Dam," "Eddy Dam," and "Six Mile Dam") is about 7 miles south of McMillan Dam and about 4 miles north of Carlsbad. The dam functions as a diversion structure while supplementing Lake McMillan's storage capacity; it intercepts the Pecos River's entire flow. The reservoir capacity is approximately 6,900 acre-feet. Avalon Dam was originally constructed in 1889-1890. The 1889 dam was destroyed by an 1893 flood and rebuilt; in turn, the 1893 structure was destroyed by floodwaters in 1904. The current Avalon Dam dates from 1907.

The first Avalon Dam was designed by H.H. Cloud, who had formerly worked as an engineer for the Colorado Midland Railroad. Cloud designed the dam as a "prism of loose rock" with an upstream face of earthfill.[4] The rock was placed in lifts of 4 to 10 feet beginning on bedrock. The rockfill portion of the dam was separated from the impervious earthfill by a hand-laid rock wall with a slope of 0.5:1. The dam's maximum height was approximately 40 feet, with a crest length of approximately 1070 feet. The rockfill was 100 feet wide at the bottom and 12 feet wide at the top with a downstream slope of 1.5:1. The earthfill, comprised of sacked earth, gravel, boughs, and loose earth, had a slope of 2:1. Riprapping, 18 inches thick, protected the dam against wave action. The toe of the upstream face of the dam was protected from undercutting with 10 feet of loose rock fill. The earthfill washed out shortly after construction and was replaced with fill 200 feet wide at the bottom and 10 feet wide at the top with an upstream slope of 3-3.5:1. Although not mentioned in a description of the dam while it was under construction, by the fall of 1891, the dam is described as being in the shape of the letter L with the short leg pointing upstream. The short leg, constructed of earthfill, added 530 feet to the length of the dam.[5]

A 90-foot-long scourway passed through the first Avalon Dam at its eastern end, with an opening 4 feet by 8 feet. The scourway was constructed of stone laid in concrete; it was capable of discharging 2000 second-feet of water with the reservoir full. Drawings of the dam under construction show the scourway walls flaring outward both above and below the dam. A 36-foot-long vertical screw operated a gate placed at the upstream side. The scourway was intended to lower the reservoir in anticipation of floodwaters, although by 1896, the Engineering News reported that the scourway "was found to be of no value and was removed."[6]

A flood in August 1893 overtopped the first Avalon dam and washed it away. The reconstructed dam was increased to a length of 1,135 feet and the crest raised five feet. The 1893 structure reportedly had a crest width of 20 feet and a maximum height of 45 feet. Drawings show the downstream slope of the rockfill as 1:1, the "rough laid wall" as 0.5:1, and the earthfill, upstream slope as 3:1.

Avalon Dam was again breached by flood waters in 1904; approximately 450 feet of the 1893 dam was washed out. After considering several alternatives, the Reclamation Service reconstructed Avalon Dam in a configuration similar to that of the old dam. The major modification was the addition of a combination concrete and steel sheet piling core wall. The width of the rockfill crest was increased 33 feet on the upstream side of the dam to permit the core wall to clear the inside slope of the old rockfill. The rubblestone concrete core wall placed in the new section of the dam was 3 feet wide at the top and battered 1:24 on both sides. To avoid trenching in the surviving portions of the old dam, steel sheet piling driven to bedrock was substituted for the concrete. The core wall was raised to an elevation 24 feet below the crest of the dam (the elevation of the surface of the water in the canal). A reinforced concrete diaphragm 12 inches thick was then attached to the top of the concrete and steel and brought to the crest of the dam where its section was reduced to 8 inches. The earth fill on the upstream face of the dam, while retaining the original 3.5:1 slope for approximately 3/4ths of the height of the dam was then increased to a 2:1 slope to the crest. The earthfill was riprapped with 12 inches of limestone.

In 1936, CCC crews raised the crest of Avalon Dam by building a masonry wall on top of the dam's concrete diaphragm. The rockfill portion of the dam was raised 6 feet to conform with the height of the new retaining wall, resulting in an elevation of 3194 feet. This construction project left the dam in the configuration which exists today.

The dam's outlet works are located at the lower end of a 250-foot-long channel, 100 feet wide, cut through solid limestone at the east side of the dam. The outlet works control the flow of water into the irrigation system's main canal. Avalon's original outlet works consisted of 6 wooden gates which slid between vertical wood posts, providing a discharge capacity of 3,000 second-feet. The gates, each 5 feet wide by 9 feet high by 6 inches thick, were operated by hand. The current reinforced concrete headgate structure dates from 1907. This hollow structure, 31 feet high by 33 feet, 6 inches long, has a bottom width of 27 feet, 8 inches sloping inward on the downstream face to a top width of 8 feet 3 inches. Six 4-foot by 6-foot sluiceways passing through the base of the structure are controlled by metal sluicegates operated by ball-bearing gate stands. A reinforced concrete slab "box" atop the sluicegates creates a cavity filled with puddled earth and rock to provide loading to counter the upward pressure of the reservoir.

Two additional sets of gates were originally located below the outlet works but are now gone. One set across the canal just below an arroyo controlled water entering the canal and another just above them in the bank of the canal served as a wasteway.

10) AVALON SPILLWAY NO. 1

The original Avalon Dam was provided with two spillways; a third was added after the floods of 1893. Spillway No. 1 was located in the diversion channel above the outlet works. It was 206 feet long and was located 7 feet below the crest of the dam. The spillway featured a total of 31 gates, 5 feet wide by 7 feet 2 inches high. The gates could be swung open horizontally by a "blow on [a] vertical releasing rod." Flashboards were provided to enable the gates to be closed.[7]

Changes to all three Avalon spillways took place in the years immediately following the Reclamation Service's 1905 acquisition of the system. In 1908, the Reclamation Service constructed a new concrete Spillway No. 1, featuring 39 pairs of wooden, "quick acting emergency gates of special design," each 5 feet wide and 10 feet high; one gate of each pair opened upstream, the other downstream. Although the gates were intended to be "quickly opened and closed by water pressure," they were not successful and were replaced in 1911-12 by the current "cylinder gates."[8]

These cylinder gates, designed by Reclamation Service engineer Frank Teichman, are located about 75 feet apart just behind Spillway No. 1. The wooden gate openings were closed with concrete to create an overflow spillway. The 21-foot diameter cylinder gates consist of braced steel shells 8 feet high. The upper rim of the shell is just above the crest of Spillway No. 1; the lower rim of the shell rests on sill castings embedded in the mouth of a 20-foot diameter L-shaped concrete spillway tunnel. The tunnel discharges downwards and tapers to 17-foot diameter before curving to form a depressed horizontal tunnel. The tunnels were inclined to throw discharged water away from the toe of the dam. The gates are operated from a triangular concrete platform placed between concrete columns. Steel runners riveted to the shell of the gates move in cast iron guides built into the columns to insure direct vertical movement. Three-inch diameter screws fastened to the upper rim of the gates extend above the concrete platforms where they are connected by gearing. The gates can be raised either with a hydraulic turbine or by hand, assisted by counterweights.

11) AVALON SPILLWAY NO. 2

The original Spillway No. 2 was at the west end of Avalon dam, at the head of a 300-foot-long channel. It was 256 feet wide at an elevation five feet below the dam's crest. Following Avalon's destruction in the flood of 1893, Spillway No. 2 was lowered and its width increased to 240 feet; the 1893 version of the spillway was fifteen feet below the crest of the dam.

In 1911-12, Spillway No. 2 was reconstructed as a circular concrete overfall dam between two concrete abutments. The overfall dam, also designed by Teichman, is about 393 feet long, forming a full quarter of a 250-foot circle. The overfall is divided into two sections: the eastern portion is a ogee-section gravity dam with an apron at the bottom, while the western section is a concrete cut-off wall protected by two concrete steps, resembling a giant amphitheater. A 5-foot-wide division pier in the shape of the steps supports the gravity portion of the spillway. The crest of the spillway is at an elevation of 3177.8 feet; it is capable of discharging 65,000 cubic-feet/second.

12) AVALON SPILLWAY NO. 3

The first Spillway No. 3 was constructed in 1893; it was a 300-foot-wide structure located to the west of Spillway No. 2, and at an elevation 15 feet below the crest of Avalon Dam. Initially, Spillway No. 3 was blocked by an earthen dike which was designed to wash out during a major flood.

In 1915, the Reclamation Service replaced the earthen dike at Spillway No. 3 with a 3-foot-wide, 400-foot-long, stone weir. The crest of the spillway is at elevation 3177.8, the same as Spillway No. 1; its capacity is 46,000 cubic feet/second. The spillway discharges through a 3,000-foot-long channel into the Pecos River below the dam.

13) AVALON SUSPENSION BRIDGE

The suspension bridge at Avalon Dam spans the headworks diversion channel at the east end of Avalon Dam and provides access to the top of the dam. The bridge was designed by the Denver Office of the Bureau of Reclamation and constructed by CCC crews in 1939 under the supervision of a Bureau of Reclamation foreman. The structure replaced an earlier wooden bridge which had been constructed by the Reclamation Service in approximately 1906. The bridge's 1-inch diameter main cables are 6 feet apart, and span 190 feet between two timber towers. The cable is designed to incorporate a sag of 19 feet and is divided into 15 panels by 3/4-inch suspender rods. The rods support 6 x 6 transverse floor beams which in turn support 6 x 8 stringers and 2 x 6 decking. A wooden handrail with horizontal rails is supported by knee braces from the floor beams. The 21-foot-high, 10 x 12 timber tower legs are cross-braced with 2 x 10s. Massive concrete anchorages are placed 28 feet behind the two towers.

14) AVALON WATER DISTRIBUTION SYSTEM

The low, open, water tank is located on a rise approximately 230 feet east of the Avalon Gate Keeper's House. The 33-foot square limestone tank was constructed by the CCC in 1940. It was filled by a hydraulic ram and stored water to irrigate the extensive landscaping installed by the CCC. Two small limestone structures associated with the water distribution system are located below the Dam's outlet works. The lower structure is a 8-foot, 2 inch by 10 foot, 10 inch limestone structure with concrete cap set into the hillside. It originally housed the hydraulic ram. Above this structure is 5 foot, 10 inch square limestone structure with an open top covered with a mesh screen which housed the lift.

15) AVALON GATE KEEPER'S HOUSE

The Avalon gate keeper's house is a vernacular building located along the entrance road to the southeast of the dam. The Pecos Irrigation and Improvement Company constructed the original portion of the one-story, T-shaped house in 1892. The house has a gable roof with a rear hip and an exterior fireplace chimney on the northeast end (which has been lopped off at the roof level). The front portion of the original house measures 29 feet by 14 feet; the rear ell measures 18 feet, 6 inches by 15 feet, 6 inches. An enclosed porch, 26-feet x 10-feet 2-inches was added to the front of the house at some undetermined date. In 1936, the CCC added a shallow shed-roofed addition which wrapped around the northeast and southeast (rear) sides of the building. Another small addition was added to the southwest side of the building. Only one original 1-over-1 double-hung window remains visible from the exterior of the house at the southwest end. The remainder of the windows are 6-over-6 double-hung. The house and the additions are faced with coursed, quarry-faced, native limestone. The wood shingled roof has been covered with corrugated steel.

The landscaping at the Avalon gate keeper's house was installed by the CCC during 1939 and 1940. It consists of a series of eight terraces in front of the house and three terraces at the back of the house. The terraces at the front of the house are defined by low stone walls which step down towards the headworks channel at 2-foot elevation change intervals. The terraces at the rear of the house are also at 2 foot elevation change levels surrounded by an approximately 4-foot-high limestone masonry wall on the northeast, southeast, and southwest sides. A 6-foot-high crenelated limestone masonry wall between the house and warehouse closes the northwest side. A flagstone paved walk extends from the southeast corner of the house, along the rear of the house and across the first two terraces in a southwesterly direction. Flagstone paving also exists between the house and the cistern. Some of the back terraces are maintained in lawn, but all evidence of the plantings and lawns placed by the CCC on the front terraces are gone; they are currently surrounded by an electric fence and used as an animal enclosure.

16) AVALON GARAGE and 17) AVALON WAREHOUSE

The garage and warehouse, both of vernacular design, are located to the southeast of the house and joined to it by a stone wall. The CCC constructed both buildings in 1940. The 14-foot, 10 inch by 50-foot, 6 inch warehouse has a gable roof. All windows in the building are 6-over-6 double-hung. A loading door opens on the southwest end and there is an exterior chimney on the northeast end. The building was originally faced with stucco, but a facing of flat stones was applied soon after construction.

The garage is attached to the southeast corner of the warehouse. It is constructed of large, coursed limestone and has four bays separated by stone piers. The 50-foot, 6-inch by 22-foot gable-roofed building has a chimney on the southeast end and four low windows below the soffit on the northeast side.

18) AVALON GUARD HOUSE

The 12-foot, 3 inch by 8-foot, 3 inch guard house is located near the southeast end of the suspension bridge. The date of construction has not been verified, although the stucco and stone work suggest CCC work. The stuccoed building, of vernacular design, has a door on the front and boarded-up windows on all sides. An exterior stuccoed chimney rises from a limestone masonry base on the southeast side of the building.

19) AVALON STORAGE BUILDING (non-contributing)

A below ground, concrete covered cistern, 13-feet x 12-feet 8-inches, is located about 14 feet from the southeast corner of the house. It was constructed by the CCC in 1936 and is now covered with a new storage building, ca 1970. The building has T-111 siding and a corrugated steel roof.

20) "MAIN" OR "SOUTHWEST" CANAL

The Carlsbad Irrigation District's canal system has its head at Avalon Dam, where the route of the Main Canal begins. (This canal was also known historically as the "Southern" Canal; this name still appears on some current USGS maps.) From Avalon, the Main Canal flows southward along the east side of the Pecos River towards the city of Carlsbad. The canal system divides about 3 miles below the outlet works, with the smaller East Side Canal (described below as Feature #24) diverging to the east and the Main Canal continuing southward. About 1/3 mile south of the division, the Main Canal crosses the Pecos River on the arched Pecos River Flume (described below as Feature #25). From there, the canal flows southward along the west side of the Pecos River for some 15 linear miles (more than 25 canal miles), ending at a point about 3-1/2 miles northwest of Malaga. (The Main Canal continued south to the Black River Canal in the 1890s, although this segment was abandoned by 1904.) Beyond the terminus of the Main Canal, the Black River Supply Ditch extends south for approximately 3-1/2 miles discharging into the Black River at a point just above the Black River Dam (see Feature descriptions #27-29, below). The Black River Canal begins at the Black River Dam and extends in an easterly direction for approximately 6 miles, passing through the small community of Malaga.

A number of major and minor structures are on the Main Canal's route, including wasteways, canal checks, lateral turnouts. The Pecos River Flume and the Dark Canyon Siphon are the largest and most complex of these structures; because of their unique design and historic significance, they are considered as separate contributing elements and are described separately below. Smaller-scale canal features are recurring and do not exhibit unique design qualities; they are described in conjunction with the canals themselves.

From Avalon Dam to the bifurcation works, the Main Canal is an unlined channel about 45 feet wide with side slopes of 1.5:1. Service roads, integral to the canal's operation, parallel both sides of the canal. About 1-1/2 below Avalon Dam, a turnout gate on the west bank of the canal supplies water to a concrete-lined lateral which leads to the Pecos River Siphon (constructed 1915), a 21-inch square concrete conduit which carries water beneath the Pecos River to a small area of irrigated lands to the west. There is a concrete Parshall flume (a specially-designed section of ditch through which the rate of flow may be measured) just upstream from the inlet. On the north side of the ditch between the inlet and the Parshall flume is a concrete wasteway for discharging excess water.

<u>21) CANAL BIFURCATION WORKS</u>

At the bifurcation works, the canal widens into a small basin. The works consist of three sets of gates: the East Side Canal Turnout (see Feature description #24, below), Wasteway No. 1, and Check Gate No. 1. Wasteway No. 1 is a 33-foot-wide concrete gate structure housing six 4-foot by 4-foot cast-iron slide gates. The gates are operated by screw lift mechanisms. Bridging the gate openings is a concrete control platform, about 8 feet above the canal grade, which supports the control stands for the gates. The wasteway gates are used principally to remove flood waters or other excess water in the Main Canal from the distribution system. Water discharged through the wasteway gates eventually flows into the Pecos River just downstream from the Flume. A low stone wall protects the toe of the terrеplein approaching the flume along a portion of the channel.

Check Gate No. 1, on the Main Canal, displays a configuration nearly identical to that of Wasteway No. 1.

The Main Canal is concrete-lined from the bifurcation point downstream to the Pecos River Flume, approximately 1/2 mile. This section of lining was installed in 1925. Beyond the flume, the Main Canal is about 30 feet wide and unlined for a distance of about 14 miles where the concrete lining resumes and continues to the Canal's termination. A maintenance road parallels the Main Canal from Carlsbad to the canal's end.

22) CANAL WASTEWAY NO. 2

Wasteway No. 2 is located just above the Dark Canyon Siphon, about 4 miles below the flume. The wasteway was originally similar to the East Side Canal Turnout, with two 4-foot by 4-foot openings controlled by wooden slide gates with cast iron screw lifts. A 34-foot-long concrete spillway extends from the wasteway's north abutment. Wasteway No. 2 is now abandoned, and the seven 1-foot 6-inch by 4-foot openings designed to hold spillway flashboards have been filled with concrete.

23) CANAL WASTEWAY NO. 3

The Cass Draw Wasteway (Wasteway No. 3) is approximately 8 miles beyond the Dark Canyon siphon. It is a concrete structure with three openings, each 3.5 feet by 6 feet. The wooden slide gates are controlled by cast iron screw lifts. The Wasteway is designed to evacuate flood waters entering the Main Canal from surface drainage.

Beyond the Pecos River Flume, the most common ancillary structures along the Main Canal are the lateral turnouts. Many of these turnouts are of recent construction, consisting of sliding steel gates lifted by a screw stem threaded through a wheel and supported by an overhead angle-section frame. Three of the turnouts are wood. At least two (numbers 11 and 23 1/2) retain the Reclamation Service's original standardized design. These plans called for concrete structures 4 feet wide by 8 feet, 6 inches high. Five-foot-long sloping wingwalls extended from 2-foot-long sidewalls. From the turnouts, an opening 2 feet in diameter accesses a single-hub concrete pipe which ran beneath the maintenance road into the laterals. The round cast iron gates are controlled by cast iron screw lifts.

There are several types of check gates located in the Main Canal and many concrete frames which once supported additional check gates. Most common are concrete structures with wooden screw lift gates supported by timber structural members.

The Carlsbad Irrigation District serves project lands with water through a network of over 100 miles of laterals and sub-laterals ranging in capacity from a maximum of 60 cubic feet per second to a minimum of 5 cubic feet per second. Most of the laterals are lined with concrete, while some are unlined. The Carlsbad Irrigation District lined or re-lined most of the laterals between 1969 and 1974.

Although the Project's complex network of laterals and sub-laterals is vital to the system's operation, several factors dictate their exclusion from this historic district. The recent lining of the laterals with concrete significantly altered their visual qualities and reduced their level of historic integrity. In addition, existing records do not allow for substantiation of the continuity of routing or use of Project laterals.

24) EAST SIDE CANAL

The East Side Canal begins at the bifurcation works about 3 miles below Avalon Dam. The East Side Canal Turnout consists of a concrete gate structure housing two 4-foot by 4-foot cast iron slide gates, each operated by screw lift mechanisms. Bridging the gate openings is a concrete control platform, about 8 feet above the canal grade, which supports the control stands for the gates.

The East Side Canal flows in an easterly and southeasterly direction from the Main Canal. The Canal is relatively short (approximately 6-1/2 miles), although preliminary grading for a much longer canal was completed ca. 1890; reportedly, most of the lands to be served by the longer canal were later found unsuitable for cultivation. Although smaller than the Main Canal, the East Side Canal has similar design qualities and possesses many of the same ancillary features. Laterals from the Canal branch to the south, primarily serving the northern suburbs of Carlsbad. The first 4 miles of the canal and some of the laterals were lined in 1938 and 1939 by CCC crews. Some of this lining is concrete while other lining is with flat stones. The East Side Canal has a capacity of 50 cubic feet per second.

25) PECOS RIVER FLUME

Just below the junction of the Main and East Side Canals, the Main Canal crosses the Pecos River by means of a concrete flume located between two terrepleins. The current structure is at least the third flume at this location. The first Pecos River Flume (1889-90) was a long wooden structure resting on a series of trestle bents. This flume was destroyed in the flood of 1893 and was replaced in-kind the following autumn. By the beginning of the twentieth century the 1893 structure was considered so deteriorated that its collapse was predicted as imminent, prompting the 1903 construction of the present flume.

The Pecos River Flume was designed by Thomas Taylor Johnston, a civil engineer from Chicago, and constructed at a cost of $50,000. On its completion, the 492-foot-long by 47-foot-high Pecos River Flume was the largest irrigation flume in the United States.[9] Four pairs of arches, 100 feet by 25 feet, support a massive concrete trough which has a capacity of 1500 cubic-feet per second. The arch rings are 5 feet thick and spring from grade. Piers 8 feet thick stand between each pair of arch rings. The 4-foot-thick floor of the flume is contiguous with the arch rings. The side walls of the trough are inset from the outer edges of the floor 6 inches on each side. They are 18 feet high and 2 feet thick. 16,000 lineal feet of rails at 4 feet on center were placed in the floor and walls of the trough and tied across the top to carry stresses in the floor and provide lateral bracing for the walls.

The flood of 1904 seriously damaged the flume, washing out the banks at either end and undermining the foundation. The Reclamation Service undertook an extensive rehabilitation of the flume in 1906. Workers lengthened the concrete wingwalls, increasing the flume's overall length to 560 feet. Among other improvements made by the Reclamation Service was the widening of the foundations for the piers. This work has since been encased by stone masonry cutwaters built by the CCC in 1939.

26) DARK CANYON SIPHON

The Dark Canyon Siphon was constructed by the Reclamation Service in 1907 to carry the Main Canal beneath Dark Canyon (spelled "Cañon" in some early sources). The siphon was intended to isolate the canal infrastructure from damage caused by the canyon's frequent floodwaters, and supplanted a small earthen dam which originally guided the canal's flow across the canyon. The inverted concrete siphon was originally 400 feet long and 6 feet in diameter. In 1915, the siphon's lower end was lengthened, extending the structure's total length to 600 feet. Simultaneously, the outlet was enlarged from 6 feet in diameter to 9 feet square. The siphon has a capacity of 400 cubic feet per second.

27, 28, and 29) BLACK RIVER SUPPLY DITCH, DIVERSION DAM, AND CANAL

The Black River Canal was originally a lateral of the Main Canal and was supplied with water which was carried across the Black River in a wooden flume. After the flume deteriorated, the Pecos Irrigation and Improvement Company constructed the Black River Diversion Dam to supply water to the Canal.

The Black River Dam is a stone dam extending 90 feet across the Black River. It is 6 feet high and is buttressed on the downstream side. The original stone was covered by a thin layer of concrete at an unknown date.

In 1907, the Reclamation Service extended a ditch from the termination of the Main Canal (to the east of the earlier abandoned Canal location) to supply supplemental water to the Black River Canal when the flow of the river was not adequate to meet irrigation demands. About 2 miles of the 3.5-mile-long ditch were lined with concrete in about 1970; it has a capacity of 75 cubic-feet per second.

The Black River Canal begins at the Black River Diversion Dam and flows in an easterly direction for about 6-1/2 miles. Much of the Canal was reconstructed by the Reclamation Service in 1907. A portion of the canal was relined in about 1970. Capacity is 50 cubic feet per second.

30) FIRST NATIONAL BANK OF EDDY

This Italianate commercial business block, located at 201 South Canal Street in the City of Carlsbad, has housed the offices of the Carlsbad Irrigation District and its corporate predecessors since the building's construction in 1890. During its early years, the building simultaneously housed local offices of the Pecos Irrigation & Improvement Company, the Pecos Valley Railway, the Pecos Valley Town Company, and the First National Bank of Eddy. The building has been a visual landmark of Carlsbad's commercial district since its construction, and remains today the town's most substantial example of nineteenth-century commercial architecture. The building was individually listed in the National Register on December 12, 1976.

The building is a two-story commercial block measuring 55 by 85 feet. It was designed by architect E. Krause of El Paso, Texas, and constructed by Caples and Hammer of El Paso. The building stands at the intersection of Fox and Canal Streets, and has primary facades facing both streets. The exterior walls are approximately 16 inches thick and constructed of locally-produced brick. The primary facades are visually defined by an angled metal parapet atop the cornice. The horizontal lines of the parapet and cornice are repeated in a metal string course separating the building's first and second floors. The parapet conceals the building's slightly sloping metal roof.

Between them, the building's two primary facades include five principal historic entrances (described below). The first floor facades also include transomed plate glass store fronts and paired 1-over-1 double-hung windows beneath segmental brick arches. Second floor fenestration consists of 1-over-1 double-hung windows arranged in groups of 1, 2, and 3. The window openings feature semicircular arches; they are above a sill course and connected by a continuous brick string course.

The northeast corner of the building is angled; it contains a pair of transomed doors which originally entered the offices of the First National Bank of Eddy. The entry is flanked by cast iron columns and crowned by a low pediment incorporated into the string course. The second floor window above this entrance is slightly larger than adjacent windows; it is topped by a cut stone tablet reading "First National Bank." A Mansard-roofed area with a diamond-shaped window tops the corner.

The entrance to the historic offices of the Pecos Valley Town Company is at the south end of the east facade. These double doors are set in an arch framed by sheet metal columns and topped by a large pediment. A second, smaller pediment is in the parapet above. The entry area is further defined by brick pilasters on both the first and second floors. A third entry, marked by double doors, is at the approximate midpoint of the east facade. This entry was originally open, providing access to a stairwell leading to the building's second-floor offices.

The entry at the west end of the north facade originally provided access to the offices of the Pecos Valley Railway. Here, the double entry doors were topped by a fanlight and set in a semicircular stone arch. Brick pilasters define this area; the entry is further marked by a large triangular gable extending above the level of the parapet. (The original doors and fanlight have been replaced with a modern door and concrete block fill.)

The building's original interior plan largely survives in 1991. On the first floor, portions of the original high, pressed-metal ceilings remain, as do two marble fireplaces located in the former bank offices. The original two-story vault remains in the center of the building. Considerable historic finishes, fixtures, and wood trim survive on the first floor and are intact on the now-vacant second floor.

Endnotes for Section 7

1. James Dix Schuyler, <u>Reservoirs for Irrigation, Water-Power, and Domestic Water-Supply</u> (New York: John Wiley & Sons, 1902), 55.

2. "Lake McMillan Dam, Pecos River," <u>Engineering Record</u> (June 9, 1894), 24.

3. Ibid.

4. L. D. Blauvelt to C. B. Eddy, 12 March 1893, files of the Pecos River Projects Office, Bureau of Reclamation, Carlsbad, New Mexico.

5. L. B. Howell, "The Pecos Valley Irrigation System," Engineering News 36 (17 September 1896), 181.

6. L. B. Howell, "The Pecos Valley Irrigation System," Engineering News 36 (17 September 1896), 181.

7. For early descriptions of Avalon Dam see: "Rock Fill Dam Across the Pecos River," Engineering News 23 (17 May 1890), 459-460; Follett, "Earthen vs. Masonry Dams," 28-29; and Wilson, "Pecos Valley Canals," 350-351.

8. Department of the Interior, Sixth Annual Report of Reclamation Service, 1906-1907 (Washington: GPO, 1907), 150. Untitled construction drawing of the gates, Number 5-500-231, Box 16, National Archives--Denver Branch, Denver, Colorado. Department of the Interior, U.S. Reclamation Service, "Carlsbad Project, New Mexico: Project History," 1912, Carlsbad Irrigation District Office, Carlsbad, New Mexico.

9. C. J. Blanchard, "Millions for Moisture: An Account of the Work of the U.S. Reclamation Service," National Geographic Magazine 18 (April 1907): 223.

increasingly sophisticated projects of the young U.S. Reclamation Service. The Project's history thoroughly depicts the most prominent historical themes of both eras -- from the dramatic, unrealized dreams of private western "boosters" to the more pragmatic, but equally complex and difficult, aspirations of early federal reclamation workers. In many ways, the Carlsbad Project represents the quintessence of each of the two eras; the Project's unique melding of these two significant stories gives it a unique national stature.

Historical Narrative

The roots of the future Carlsbad Irrigation District date from the early 1880s, during the first years of significant Anglo-American settlement in the lower Pecos Valley of southeastern New Mexico. Although most of these early settlers worked at establishing ranch operations, by the mid-1880s some were supplementing their ranching activities with small tracts of irrigated farmland using small, private canal systems leading from the Pecos River or its tributaries. Among this group were Pat Garrett, the noted former sheriff of Lincoln County, New Mexico, and Charles B. Eddy, a young cattleman with rapidly expanding interests in both Colorado and New Mexico. Both men apparently harbored dreams of expanding their private canals into far larger corporate reclamation efforts, and by 1888 Garrett and Eddy had unified and codified their plans in the form of the new "Pecos Irrigation and Investment Company." This corporation was based on the stated goal of constructing large, complex irrigation systems at several locations along the lower Pecos Valley.[2]

In forming the Pecos Irrigation and Investment Company, Garrett, Eddy, and their associates were representative of a large-scale interest in reclamation in the western United States during the late nineteenth and early twentieth centuries. Numerous similar irrigation projects were envisioned or underway in every western state by the late 1800s, in large measure due to the efforts of private corporations. Although western geologists and geographers (such as John Wesley Powell) urged that restraint and cautious federal planning oversee western reclamation development, the government initially adopted a laissez-faire attitude toward the issue. When government policy did intervene, as with the implementation of the Carey Act (1894), it was generally to encourage, rather than regulate, private reclamation development. As a result, the Pecos Irrigation and Investment Company, and its contemporaries, had nearly free rein to explore the economic and engineering possibilities of western reclamation. More often than not, though, their efforts met with failure rather than success.

In New Mexico, the Irrigation Company began substantial work near the community of Roswell during the late 1880s, but reclamation efforts in the area that was later to become Carlsbad (where Eddy's private canals had been developed) initially remained in the planning stages due to inadequate funding. Consequently, the company's backers soon began to actively solicit funds from outside investors; they quickly met with the success that allowed construction to begin in the future Carlsbad area. Funding was successfully solicited from a variety of financiers and entrepreneurs, the most significant of which was James John Hagerman, a Colorado Springs capitalist with a background in railroads, mining, and iron processing. Hagerman and his associates rapidly became the dominant financial force behind Pecos Valley irrigation, and they remained so for much of the next decade. Under Hagerman's leadership, the corporate reclamation effort was reorganized as the "Pecos Irrigation and Improvement Company" in 1890, with Hagerman and Eddy as its principal boosters. Hagerman supplemented his promotion of the reclamation system by sponsoring the construction of the Pecos Valley Railroad to provide a shipping route for the Valley's products.[3]

The Irrigation Company's planned construction near the new community of Eddy (later to be renamed Carlsbad) was underway by the end of 1889. This work included a diversion/storage dam (given the name "Avalon") across the Pecos River and primary canals running southward along both sides of the River. Avalon Dam was a long, low rockfill structure with an upstream facing of impermeable earthfill. The company's "Main" canal began at Avalon Dam and followed the river's eastern bank downstream; the channel divided near the Eddy townsite. It crossed to the western bank by means of a large wooden flume supported by trestle bents. The Irrigation Company's canals were all unlined and simply, hastily built; as a result, water loss from seepage and evaporation was tremendous.[4]

Construction of the Pecos Valley reclamation system was accompanied by a substantial program of land promotion and town development. Most of these entrepreneurial efforts were sponsored by the same individuals and groups who were financing construction of the irrigation network. A substantial brick commercial block (1890) was constructed in downtown Eddy to house the varied corporate efforts of the Valley's boosters: the Irrigation Company, the Pecos Valley Railroad, the Pecos Valley Townsite Company, and the First National Bank of Eddy. This building continues to house the offices of the Carlsbad Irrigation District today.[5]

Both Avalon Dam and the initial canal network were largely complete by late 1890, and the Company began local deliveries of irrigation water. Although corporate forecasts had predicted eventual irrigation of as much as 1,000,000 acres of the Pecos Valley, early water deliveries were far more limited and the Irrigation Company never served more than 15,000 acres from its Carlsbad-area network. Initially, the system was hampered both by its rapid and inefficient construction and the lack of a storage reservoir on the Pecos; the Irrigation Company attempted to solve the latter problem in 1893 by beginning construction of an upstream dam (McMillan) intended to increase the system's storage capacity.

Unfortunately, that summer a major flash flood destroyed Avalon Dam and damaged the still-uncompleted McMillan.[6]

Following the flood of 1893, the Irrigation Company quickly rebuilt Avalon Dam and completed McMillan Dam, using funds personally provided by Hagerman. Although this work allowed the canals to reopen and stabilized their operation, the combined difficulties of flooding and unrealized expectations began to drain the enthusiasm of both Eddy and Hagerman. Eddy left the valley in 1895, and Hagerman began concentrating on the Roswell area to the exclusion of Carlsbad. The Irrigation Company remained in the financial doldrums throughout the decade, mirroring the Pecos Valley's general lack of economic success. The Valley's difficulties reflected unsuccessful attempts to find appropriate local crops and farming methods, despite numerous experiments sponsored by the Irrigation Company's backers.[7]

As a result of Hagerman's refusal to continue bankrolling the chronically unprofitable Irrigation Company, the corporation lapsed into bankruptcy in 1898. During the reorganization, the Company's Roswell and Carlsbad operations were separated administratively, and the Carlsbad system emerged in 1901 as the new Pecos Irrigation Company, under the leadership of Francis G. Tracy. Tracy kept the Company marginally profitable during its first years, and found funding to replace the old wooden Pecos flume with a striking new concrete arch structure in 1903. The following year, however, disaster again struck the company, as yet another Pecos flash flood destroyed the 1893 Avalon Dam. This made the irrigation system inoperable; the situation was compounded by the Irrigation Company's unwillingness and financial inability to fund the needed repairs.[8]

It was rapidly evident to all concerned that the system's only hope for survival was its acquisition by the federal government's newly-formed United States Reclamation Service, and the affected farmers immediately formed an advocacy group, the "Pecos Water Users' Association," to push for such a takeover. While discussions on the system's sale continued, as a first step, the Reclamation Service agreed to supervise construction of a temporary replacement for Avalon, thus restoring water to the canal system. Actual construction work was performed by the Irrigation Company, using money raised by the Water Users. Unfortunately, the temporary dam failed as it was being filled for the first time in June 1905, condemning the district's farmers to a long period without vital irrigation water and marking an inauspicious local debut for the Reclamation Service.[9]

The failure of the 1905 temporary dam made Reclamation Service takeover of the Irrigation Company's assets more crucial than ever, and the sale was finally consummated by December 1905. Final negotiations provided for the government acquisition of the entire Irrigation Company infrastructure, including its headquarters building in downtown Carlsbad; in return, the Irrigation Company received a $150,000 payment from the government's Reclamation Fund. Federal reconstruction of the damaged Irrigation Company infrastructure began almost immediately, as the "Carlsbad Project" of the U.S. Reclamation Service. Although much of the private system was rehabilitated during the first three years of Reclamation Service ownership, the most significant development was the reconstruction of Avalon dam, this time featuring a new concrete and steel corewall. The replacement dam was completed in 1907, allowing a portion of the irrigation system to return to service. As further improvements were completed and operation of the system stabilized, additional lands within the project boundary were brought under cultivation.[10]

When a 1911 flood damaged Avalon Dam yet again, the Reclamation Service responded with further improvements to the dam and its spillways. The most noteworthy feature of this project was the installation of two vertical "cylinder gates" in the dam's outlet structure. This innovative technological effort marked the first use of cylinder gates in a spillway system, confirming a design that later reappeared, in grander scale, in other Reclamation Service/Bureau of Reclamation projects, including Hoover Dam.[11]

As federal rehabilitation and improvement projects gave the Carlsbad Project relative operational stability by the 1910s, greater attention was called to the problems of the farmers working land served by the reclamation system. The most significant such problem was the farmers' alleged inability to repay the federal cost of the reclamation system under the terms mandated by the Reclamation Service's 1902 enabling legislation. Additional controversy stemmed from the issue of "excess holdings," where individuals within the Project boundary owned more than the maximum 160 acres allowed by the federal government. These issues, which surfaced in most Reclamation Service projects, remained active for decades, although the farmers' financial hardships were gradually eased by less demanding federal legislation.[12]

At Carlsbad, these and other issues were protested forcibly by Francis Tracy, the Pecos Irrigation Company's former manager. His dissention on a wide variety of water policy issues became a major characteristic of the Carlsbad Project's first two decades. In addition, Tracy pushed hard for the system's expansion through the construction of a new "Reservoir No. 3" at a site between Avalon and McMillan. This would have allowed additional lands to come under irrigated cultivation, including large tracts at the south end of the Project area owned by the Pecos Irrigation Company. The question of possible Project expansion remained active through the 1930s, although the grand expansion schemes advocated by Tracy failed to come to pass. Meanwhile, though, the need for some form of expansion became more urgent as rapid silting progressively diminished the capacity of McMillan Reservoir. The issue was further compounded by geologists who began questioning the structural safety of McMillan Dam.[13]

It was not until the 1930s that some of these complex difficulties began to be resolved and project improvements resumed. Most of these improvements came as a direct consequence of New Deal make-work programs, particularly the Civilian Conservation Corps (CCC). Ultimately, the Carlsbad Project received two CCC camps, and its workers completed major improvement projects at both McMillan and Avalon Dams, as well as completing the concrete lining of much of the Project's canal system. Simultaneously, the project received additional water storage through the construction of Alamogordo Dam (1938), some 160 miles upstream at the head of the Pecos Valley.[14]

The advent of World War II ended the CCC program and an era of significant Reclamation Service improvements to the Carlsbad Project. Federal involvement in the Project decreased further following the War, as the Carlsbad Irrigation District (successor to the Water Users' Association) began preparing to assume operation of the local reclamation system. The transfer from federal to local control occurred on October 1, 1949, beginning a new chapter in the irrigation system's operation. Title to the property remained in federal hands, however, and the Bureau of Reclamation continued to maintain a Carlsbad office.[15]

Throughout the 1950s, 1960s, and 1970s the Bureau of Reclamation continued to ponder the dual problems of McMillan's inadequate storage capacity and questionable safety. By 1967 Reclamation had decided that the best solution would be to completely replace the McMillan facility with a new dam at a location near the Reservoir No. 3 site. The proposed new dam (given the name "Brantley") was authorized by Congress in 1972, and construction finally began in 1984. Brantley was largely finished by 1988, finally solving many of the problems of the Carlsbad physical plant and obviating the need for historic McMillan Dam, which was scheduled to be breached as it neared its hundredth birthday.[16]

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Statement of Historical Significance
(NHL criterion "1")

In retrospect, the history of the Pecos Valley's various private irrigation companies is both tenuous and disappointing, a story of huge sums of money largely wasted on false expectations and inadequate technologies. During the fifteen years that corporate reclamation was attempted on the lower Pecos, an investment of well over two million dollars failed to produce an adequate, functional irrigation network. Instead, Company engineers produced an inefficient, haphazard system, as unable to provide a consistent water supply as it was to withstand the eccentricities of the Pecos River.

Much of the blame for the private reclamation system's failure can be traced to the lack of proven irrigation technologies available to Irrigation Company engineers. Francis Tracy's analysis of the Irrigation Company as "real pioneering" was both accurate and perceptive -- the Pecos Valley's promoters were undertaking reclamation work at a scale and level of complexity hitherto nearly unknown in the American west. While this was undeniably discouraging and frustrating to the system's nineteenth-century entrepreneurs, it makes the various Pecos irrigation companies highly significant as a case study of early, large-scale western reclamation.[17]

Contemporary professional observers considered both Avalon and McMillan Dams to "most boldly exemplify" the rockfill dam technology as practiced during the late nineteenth century. Such dams, however, had to be constructed properly and later events indicated that Avalon was not. This provided the potential for a sudden, powerful flood to impregnate Avalon's earthfill with water, causing the earthfill to settle and exposing the dam's loose rock to the force of the water. This could, in turn, lead to the dam's failure. Unfortunately for the Pecos Valley's residents, the unpredictable Pecos River demonstrated just such a scenario in both 1893 and 1904.[18]

Other aspects of the system's construction also reflected incorrect design based on uninformed judgements or inadequate technology, including the roughly-built canal network and the vulnerable, ephemeral wooden Pecos River Flume. These facilities, in common with the dams themselves, reflected the philosophies of current reclamation design, but contained inadequacies that required correction before the system could fill even a portion of its intended potential.

Finally, the grandiose plans of Eddy, Hagerman, and the others were also unfulfilled due to a basic misunderstanding of the land itself. Large-scale irrigation was introduced to the Pecos Valley without a clear understanding of what the land was capable of growing, how local crops could best be managed, and the amount of return these crops could generate. Unrealistic expectations of the Valley's agricultural productivity not only left many farmers disappointed, but diminished the revenue of the irrigation companies. As with the reclamation system's engineering, the farmers' eventual success was dependent on refining and rationalizing local agricultural methods and technologies.

As a whole, then, while corporate irrigation in the Pecos Valley was ultimately unsuccessful, the experiences of the Valley's entrepreneurs served as a proving ground for the embryonic field of reclamation engineering. As the twentieth century began, this field was poised to initiate a rapid period of expansion and development, and the technologies employed in the Pecos Valley would continue to evolve. Now, however, the genesis for technological advancement was to come from the federal government rather than the private developer. Even so, the Pecos

Valley was once again destined to be a showplace for these changes, as the first Reclamation Service staffers arrived in Carlsbad in 1904.

The slow, painful evolution of the Carlsbad Project under Bureau of Reclamation tutelage mirrors, in many ways, the advancing maturation of American reclamation technology and philosophy. Reclamation Service efforts to reconstruct Avalon in 1906 and 1907, combined with its later improvements to the dam, are today highly representative of the increasing sophistication of early twentieth-century reclamation engineering. Avalon and McMillan Dams remain especially significant for their rockfill, "composite" design, and Avalon's use of an impervious corewall is also noteworthy. Avalon and McMillan were among the largest such turn-of-the-century dams in terms of length and height, and were among the first important rockfill dams with an earthfill facing in the United States.

Less-prominent features of the Carlsbad Project's physical plant also represent the early technological evolution of the Bureau of Reclamation. The most noteworthy of these are Avalon Dam's 1911 cylinder gates, an early implementation of a design form which saw later use in the intake towers of Hoover Dam. The Avalon project apparently marked the earliest use of the cylinder gate design in a major dam spillway.

In addition to the Carlsbad Project's physical landmarks, its operational history also typifies the evolution of public-sponsored reclamation in the American West. The Project's long-standing attempt to maintain fiscal responsibility without unduly burdening Project farmers replicates the primary concern of most Reclamation Service projects, and Carlsbad's relative success in achieving such a financial balance made the Project a source of federal pride. Carlsbad is also nationally representative in its long-discussed, but slowly implemented, transition from federal to local control.

Still, a number of factors make the Carlsbad Project historically unique. While the Reclamation Service imposed many of its contemporary designs on the project, these features were added to an irrigation system of private origin and largely of nineteenth-century construction. This resulted in a physical plant displaying true dichotomies of design and philosophy, exhibiting both private and public design philosophies, as well as both nineteenth- and twentieth-century engineering techniques. While the Pecos Valley was not alone in possessing a privately-constructed irrigation system that was later acquired by the federal government, the relatively massive size of the private system was unusual among such projects. Although the federal government's construction and rehabilitation investments at Carlsbad were substantial, during the Reclamation Service's first years the Project largely remained a private, nineteenth-century system imbued with the trappings of federal funding and control. Although this characterization gradually faded with each government improvement project, the dichotomy remains sharply visible today.

Engineering Significance of Major Project Features
(NHL criterion "4")

Among the irrigation system's physical features, Avalon and McMillan Dams were easily the largest and most significant. The rockfill design of both structures represented innovative reclamation engineering for the day, as one stage in a complex evolutionary process of dam design. Rockfill dams such as Avalon and McMillan consist of loose, dumped rocks which, by their mass, resist the horizontal force of the water the dam impounds. The dam must rely on an impermeable zone or membrane to keep water from passing through it. Rockfill dams may be divided into two categories, those with a waterproof upstream face and those with an impermeable core. In twentieth-century practice, the upstream face of the former is generally concrete and the core of the latter is impermeable earthfill. Rockfill dams with an impermeable upstream face are the older of the two types; the widespread acceptance of this structural form dates to the years following the California gold rush when miners needed to impound water for hydraulic mining. The earliest dams in the mining regions were small, timber-crib structures with a plank upstream face, based on a technology widely used in the eastern states. As miners built larger dams, the timber cribs became rock-filled, and eventually the timber cribs were eliminated altogether. These dams were rendered relatively impervious by anchoring an upstream face of wood planks to the rockfill. Such dams were favored because they were less expensive to construct than masonry dams and they were considered less prone to failure than earthfill dams. It was not until the late nineteenth century that the upstream wood planking began to be superseded by concrete.

Late in the nineteenth century, the use of an impermeable earth core or upstream apron became more common. Some dams had a central earthfill core with rockfill both upstream and downstream, while others simply had an upstream zone of impermeable earthfill with a gradual slope and an upstream face of rock riprap to resist the erosive action of the reservoir. As these dam forms developed, engineers finally accepted the safety of rockfill dams, or loose-rock dams as they were sometimes called. Some engineers actually considered rockfill to be the safest dam technology because of the inherent flexibility of the structure. The most highly recommended version of the rockfill dam -- used at both Avalon and McMillan -- employed the impermeable earthfill upstream zone and a riprapped upstream face. Such a structure was sometimes called a "composite dam." Some engineers preferred not to consider composite dams a sub-category of rockfill dams, because the earthfill zone made them more comparable to standard earthfill dams. Others argued that composite dams were truly rockfill dams because the mass of rock provided the main resistance to the horizontal force of water in the reservoir, while the choice of impermeable element -- wood, earth, concrete, or steel -- was of secondary importance.

By the beginning of the Reclamation Service era, dam engineers recognized the advantages of placing a corewall in earthfill and rockfill dams. The impervious corewall, usually of steel sheet piling or concrete, was carried from bedrock into the fill, thus restricting the flow of water at the interface between the earthfill and its foundation. Although at least one Reclamation Service engineer recommended that all corewalls be carried to the crest of the dam to protect against burrowing animals, in some early Reclamation Service projects the corewall was carried only a few feet upward into the fill.

Of the 37 major Reclamation Service dams and diversion dams described in the volume Irrigation Works Constructed by the United States Government, Avalon Dam is one of only three rockfill dams with an impervious earthfill upstream facing, and the only rockfill dam with a corewall extending from bedrock to the dam's crest.[19] The other two dams of similar construction were the Minidoka Dam on the Minidoka Project in Idaho (1904-06) and the Clear Lake Dam on the Klamath Project in California and Oregon (1908-10). Both of these dams had concrete corewalls only at the base of the upstream toe of the rockfill. Avalon Dam was comparable in size to Minidoka and Clear Lake, although its reservoir was far smaller than that of the others. Similarly, Minidoka and Clear Lake were components of far larger Reclamation Service projects, each helping supply water to hundreds of thousands of acres.

As the twentieth century progressed, rockfill dams continued to be popular in certain applications and, while some composite dams were built, most had concrete membranes on the upstream face. Among rockfill dams with an earthfill facing, Avalon and McMillan were among the largest built during the nineteenth century, but there were other nineteenth century dams with impermeable cores or with concrete or timber upstream faces which greatly exceeded the Pecos River dams in height. Later in the twentieth century, rockfill dams with an earthfill facing would reach heights of almost 200 feet. Nevertheless, Avalon and McMillan remain significant for their pioneering position in the evolution of rockfill dams in the United States.

Several less-prominent features of the Carlsbad Project's physical plant also represent the early technological evolution of the Reclamation Service. The most noteworthy of these are Avalon Dam's cylinder gates (1911), an early implementation of a design form which saw later use in the intake towers of Hoover Dam. The Avalon project apparently marked the earliest use of the cylinder gate design in a major dam spillway. The design is also significant for its counter-balanced hoisting works, driven by water-powered turbines.

The concrete Pecos River Flume is easily the most significant of the many structures scattered along the Project's canal network. The original flume at the site was of wood, typifying nineteenth-century American canal design. By the turn of the century, however, reinforced concrete was also commonly used to construct flumes. The adaption of masonry for bridge superstructures was a revitalization of an age-old concept, dating back at least to Roman times. The development of reinforced concrete flume designs closely followed similar developments for reinforced concrete bridges, and the earliest designs for both were arch structures. Reinforcement of the concrete with iron or steel bars allowed a significant reduction in the mass of the bridge structure. Ernest L. Ransome built the first reinforced concrete arch bridge in the United States in 1889, and by the end of the century engineers were building reinforced concrete-arch bridges with spans in excess of 100 feet. Nonetheless, Thomas Johnston's 1902 plans for the Pecos River Flume were monumental for his time, and the completed flume was regarded as the largest such structure in the United States. It is historically significant today as a massive yet graceful example of early reinforced concrete bridge design.

Endnotes for Section 8

1. National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation. (Washington: National Park Service, 1991), 50-51.

2. For information on the valley's early reclamation development, see Ira G. Clark, Water in New Mexico (Albuquerque: University of New Mexico Press, 1987), 87-89; Department of the Interior, United States Geological Survey, "Report Upon a Reconnaissance of the Pecos Valley, by Ralph S. Tarr: March 11, 1889." Record Group 115, Entry 3 (Box 443, File 651), National Archives, Washington, D.C.; Francis G. Tracy, "Eddy County, New Mexico" (typescript), WPA file #199, New Mexico State Records Center & Archives, Santa Fe.

3. "James John Hagerman: Memoirs of His Life, Written by Himself at Roswell, New Mexico in 1908." Typescript in the Rio Grande Historical Collections, New Mexico State University Library, Las Cruces; Francis G. Tracy, "Eddy County, New Mexico" (typescript), WPA file #199, New Mexico State Records Center & Archives, Santa Fe.

4. For an early description of the valley's reclamation system, see "Pecos Irrigation and Improvement Company, Report to the Stockholders, December 15, 1891." Record Group 115, Entry 3 (Box 443, File 651), National Archives, Washington, D.C.

5. National Register of Historic Places nomination for the First National Bank of Eddy building, Carlsbad, New Mexico (listed 1976).

6. "Pecos Irrigation and Improvement Company, Report to the Stockholders, December 15, 1891." Record Group 115, Entry 3 (Box 443, File 651), National Archives, Washington, D.C.; Francis G. Tracy, "Eddy County, New Mexico" (typescript), WPA file #199, New Mexico State Records Center & Archives, Santa Fe.

7. Francis G. Tracy, "Eddy County, New Mexico" (typescript), WPA file #199, New Mexico State Records Center & Archives, Santa Fe; John J. Lipsey, The Lives of James John Hagerman, Builder of the Colorado Midland Railway. (Denver: Golden Bell Press, 1968), 225-226.

8. Francis G. Tracy, "Eddy County, New Mexico" (typescript), WPA file #199, New Mexico State Records Center & Archives, Santa Fe; "History of the Carlsbad Project -- 1912," files of the Pecos River Projects Office, Bureau of Reclamation, Carlsbad, New Mexico.

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10. "History of the Carlsbad Project -- 1912," files of the Pecos River Projects Office, Bureau of Reclamation, Carlsbad, New Mexico; Department of the Interior, United States Reclamation Service, Carlsbad Project. "Project History from Inception of Project to December 31, 1913," files of the Pecos River Projects Office, Bureau of Reclamation, Carlsbad, New Mexico.

11. Ibid. Additional information on Reclamation's use of the cylinder gate design may be found in Bureau of Reclamation, Reclamation Project Data (Washington: Government Printing Office, 1941), and in Department of the Interior, Bureau of Reclamation, "Valves, Gates, and Steel Conduits," Design Standards Handbook No. 7, 1956.

12. "Report of the Central Board of Review on the Carlsbad Project, New Mexico," reprinted in Reclamation Record, July, 1916, 298-308. For additional background, see the Reclamation Service's "Project History" documents for Carlsbad, which were compiled annually beginning in 1912.

13. Ibid.

14. Department of the Interior, Bureau of Reclamation, "Twenty-Eighth Annual Report of Operation and Maintenance, Combined with the Annual Project History for the Calendar Year 1934, Carlsbad Project, Carlsbad, New Mexico," files of the Pecos River Projects Office, Bureau of Reclamation, Carlsbad, New Mexico. Additional information of CCC work and on Alamogordo's construction may be found in subsequent "Annual Reports" through the year 1941.

15. Department of the Interior, Bureau of Reclamation, "Carlsbad Project, New Mexico: Project History, 1949," files of the Pecos River Projects Office, Bureau of Reclamation, Carlsbad, New Mexico.

16. Department of the Interior, Bureau of Reclamation, "Plan of Development for Brantley Project, New Mexico," Bureau of Reclamation, Region 5, 1967; Department of the Interior, Bureau of Reclamation, "Brantley Project, New Mexico: Definite Plan Report." (Amarillo, Texas: Bureau of Reclamation, Southwest Region, 1982); "Brantley Dam Nears the End of An Era," Carlsbad Current-Argus, 20 March 1988.

17. The Francis Tracy quote is from his "Eddy County, New Mexico" (typescript), WPA file #199, New Mexico State Records Center & Archives, Santa Fe.

18. James D. Schuyler, "Reservoirs for Irrigation," Eighteenth Annual Report of the United States Geological Survey, 1896-97: Part IV -- Hydrography (Washington: 1897), 645; W.W. Follett, "Earthen vs. Masonry Dams," Engineering News, 2 January 1892, 20-29; Schuyler, Reservoirs for Irrigation, Water-Power and Domestic Water-Supply (New York: John Wiley & Sons, 1902), 51-52).

19. Davis, Arthur Powell. Irrigation Works Constructed by the United States Government. (New York: John Wiley & Sons, 1917).

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CARLSBAD IRRIGATION DISTRICT

ACREAGE OF PROPERTY

MacMillan Dam and Reservoir	4,172 acres
Avalon Dam and Reservoir	868 acres
Main Canal	303 acres
East Side Canal	79 acres
First National Bank of Eddy	less than one acre
TOTAL ACREAGE	5,464 acres

UTM REFERENCES

UTM Number:	Location:	Easting:	Northing:
A	Lake McMillan area	564630	3610020
B	Lake McMillan area	561720	3606340
C	Lake McMillan area	560140	3606170
D	Lake McMillan area	559190	3608580
E	Lake McMillan area	561430	3610830
F	Lake Avalon area	570580	3594770
G	Lake Avalon area	570250	3594780
H	Lake Avalon area	569160	3595720
I	Lake Avalon area	564800	3598530
J	Lake Avalon area	570450	3597000
K	Lake Avalon area	571900	3595260
L	canal system	569990	3590540
M	canal system	569920	3589860
N	canal system	572570	3591785
O	canal system	576710	3586260
P	First National Bank of Eddy building	572500	3586920

Q	canal system	571660	3584170
R	canal system	576840	3575180
S	canal system	580700	3570610
T	canal system	584730	3569660
U	canal system	581050	3566130
V	canal system	590850	3564880

The Carlsbad Irrigation District is located in UTM Zone 13.

Verbal Boundary Description

The historic district includes the following principal features:

* McMillan Dam and Reservoir, with its associated contiguous buildings and supporting features;
* Avalon Dam and Reservoir, with its associated contiguous buildings and supporting features;
* the right-of-way and major engineering features of the Project's Main, East Side, and Black River canals as described below; and
* the First National Bank of Eddy building in Carlsbad.

Avalon Dam and Reservoir are contiguous to the canal system; however, the McMillan area and the First National Bank of Eddy are both non-contiguous to the remainder of the District. McMillan is several miles upstream from Avalon Reservoir, and there are no relevant historic features between the two sites. In addition, the area between the two dams is now partially occupied by the modern Brantley Dam and Reservoir. The First National Bank of Eddy is located within the City of Carlsbad, separated from the remainder of the historic district by substantial non-historic development.

The McMillan portion of the historic district includes the dam and the reservoir bed to the contour at elevation 3266.6. It addition, it includes those historic features which are contiguous to the reservoir and directly associated with the reservoir's construction and/or historic operation. The boundary is described as follows:

The POINT OF BEGINNING is the center of the northern boundary of the SE¼SE¼ S30 T19S R27E [UTM point "A"]. From the point of beginning the boundary proceeds in a southwesterly direction along the downstream toe of the East Embankment (labeled "levee" on USGS map) through S30 and S31 T19S R27E and S1 and S12 T20S R26E. At the point where the East Embankment ends [UTM point "B"], the boundary turns west until it intersects contour 3266.6; thence following this contour until it intersects the line between S1 and S2 T20S R26E; thence south to the SE corner of the NE¼NE¼ S11 T20S R26E; thence west to the east toe of the abandoned subgrade of the Atchison, Topeka, and Santa Fe Railway [UTM point "C"]; thence proceeding in a northwesterly direction along the toe until it intersects the west line of the NE¼SE¼SE¼ S3 T20S R26E; thence north to the downstream toe of the West Embankment (labeled "levee" on USGS map); thence proceeding in a northwesterly direction along the toe of the West Embankment at the approximate center of the NE¼SW¼ S34 T19S R26E [UTM point "D"]; thence continuing around the perimeter of the northwest end of the West Embankment to the upstream toe; thence proceeding in a southeasterly direction along the toe of the West Embankment until it intersects contour 3266.6; thence following this elevation through S34, S27, S26 [UTM point "E"], S25, and S24 T19S R26E, and S19 and S30 T19S R27E until it intersects the north line of SE¼SE¼ S30 T19S R27E; thence east to the POINT OF BEGINNING.

The Avalon portion of the historic district includes the dam and the reservoir bed to the contour at elevation 3160.0. It addition, it includes those historic features which are contiguous to the reservoir and directly associated with the reservoir's construction and/or historic operation. The boundary is described as follows:

The POINT OF BEGINNING is the NW corner of the SE¼NW¼SE¼SW¼ S12 T21S R26E [UTM point "F"]. From the point of beginning the boundary proceeds west to the SE corner of the NE¼NW¼SE¼SE¼ S11 T21S R26E; thence in a northwesterly direction to contour 3160.0 at the NW¼NE¼SE¼NW¼ S11 T21S R26E [UTM point "H"]; thence following contour 3160.0 around Avalon Reservoir through Sections 11, 10, 3, and 4 T21S R26E, Sections 32 [UTM point "I"] and 33 T20S R26E, Sections 2, 1 [UTM point "J"], and 12 T21S, R26E, and Section 7 T21S, R27E [UTM point "K"] to the intersection of a point drawn north from the point of beginning to contour 3160.0; thence south along this line to the POINT OF BEGINNING.

Extending to the south from the Avalon portion of the historic district are the Main Canal [beginning just to the north of UTM point "G" and terminating at UTM point "T"], East Side Canal [beginning at UTM point "L" and terminating at UTM point "O"], and the Black River Supply Ditch [beginning at UTM point "T" and terminating at UTM point "U"] and Black River Canal [beginning at UTM point "U" and terminating at UTM point "V"].

The district includes a right-of-way for each of these canals extending one hundred feet in either direction from the centerline of the described canal, beginning at the southern boundary of the Avalon portion of the historic district [UTM point "G"]. Numerous small water control structures and ditch maintenance roads are included within the district, and exist within the above-described right-of-way. Major features within the right-of-way are the Bifurcation Works [UTM point "L"], Wasteway No. 2, Wasteway No. 3, Pecos River Flume [UTM point "M"], Dark Canyon Siphon [UTM point "Q"], and the Black River Diversion Dam [UTM point "U"].

The canals operate through the following sections of land:

Sections 12, 14, 23, 25, 26, 36, T21S, R26E
Sections 19, 28, 29, 33, T21S, R27E
Sections 1, 12, 13, T22S, R26E
Sections 4, 9, 10, 17, 18, 20, 21, 28, 33, 34, T22S, R27E
Sections 3, 4, 9, 10, 14, 15, 24, 25, T23S, R27E
Sections 29, 30, 31, 32, 33, T23S, R28E
Section 12, T24S, R27E

Sections 6, 7, 9, 10, 11, 13, 14, 15, 16, 17, 18, T24S, R28E

The portion of the district containing the First National Bank of Eddy building encompasses Lots 1, 3, and 5, Block 43, Original Townsite of Carlsbad, New Mexico [UTM point "P"].

Boundary Justification

The Historic District includes the dams, reservoirs, and primary canals of the Carlsbad Irrigation District. It also includes the major surviving historic features contiguous to the above features. The First National Bank of Eddy building is included as the historic headquarters facility for Pecos Valley reclamation efforts. Within the overall boundaries of the Irrigation District, these are the buildings and structures which display the highest level of historic reclamation engineering and are most integral to the total operation of the irrigation system. In general, these major features also display a high level of historic integrity.

The District does not include some less significant features which are integral to the system's operation, but are generally ancillary to the more significant features mentioned above. The District's network of lateral and sub-lateral canals falls into this category. These smaller canals do not possess nationally-significant design qualities; in addition, most were lined with concrete during the 1960s and 1970s. During the lining process, the routing of many of these canals was changed. The prior alignment of the canals is not documented, and available records cannot confirm which of these canals may exist on historic alignments.

INDEX TO PHOTOGRAPHS

Most of the photographs accompanying this nomination were taken in February, 1990 for the Historic American Engineering Record (HAER No. NM-4); original negatives are in the possession of the HAER. The appropriate HAER photograph numbers are provided in the following listing as a cross-reference.

Photographs numbered 1-12, 15, 16, 23, 27, and 30 were taken by Lon Johnson; the remaining HAER photographs were taken by Fredric L. Quivik.

Photographs 52, 53, and 54 were taken on December 15, 1994, by Robert A. Freed, of the Albuquerque Projects Office of the Bureau of Reclamation. Mr. Freed also confirmed that the 1990 photographs still reflect the appearance of the other resources in 1994.

Number	HAER Number	Description	Direction of View
2	NM-4-A-2	McMillan Dam - general view from reservoir (drained) to outlet works and gate keeper's complex	to southwest
3	NM-4-A-3	McMillan Dam - upstream face of dam with new railroad bridge in background	to northwest
5	NM-4-A-7	McMillan Dam - gate keeper's house with CCC landscaping in foreground	to southeast
6	NM-4-A-9	McMillan Dam - garage	to northwest
7	NM-4-A-10	McMillan Dam - gate keeper's house	to southwest
8	NM-4-A-13	McMillan Dam - upstream face of west embankment with railroad bed in background	to north
9	NM-4-A-15	McMillan Dam - upstream face of east embankment	to northeast
10	NM-4-A-19	McMillan Dam - concrete weir of Spillway no. 1	to northwest
11	NM-4-A-21	McMillan Dam - railroad dike and cutoff wall in Spillway No. 1 channel	to northwest

12	NM-4-A-25	McMillan Dam - Spillway No. 2 from railroad bridge	to northeast
13	NM-4-A-27	McMillan Dam - outlet works	to southwest
14	NM-4-A-32	McMillan Dam - gate house and gate stands	to southeast
15	NM-4-A-40	McMillan Dam - view of outlet works and reservoir	to northwest
17	NM-4-B-4	Avalon Dam - view of gate keeper's complex showing proximity of dam	to northwest
18	NM-4-B-5	Avalon Dam - gate keeper's complex: house (left), warehouse (right), and CCC landscaping (foreground)	to southeast
20	NM-4-B-7	Avalon Dam - gate keeper's complex: house	to south
21	NM-4-B-10	Avalon Dam - gate keeper's complex: water tank	to north
22	NM-4-B-11	Avalon Dam - gate keeper's complex: water distribution system	to east
23	NM-4-B-13	Avalon Dam - suspension bridge to crest of dam showing proximity to guard house	to north
24	NM-4-B-14	Avalon Dam - suspension bridge and outlet works channel	to southwest
25	NM-4-B-17	Avalon Dam - Spillway No. 2	to northwest
26	NM-4-B-19	Avalon Dam - Spillway No. 3	to east
27	NM-4-B-22	Avalon Dam - upstream face of dam	to southeast

29	NM-4-B-26	Avalon Dam - view up main canal from arroyo spillway	to northeast
30	NM-4-B-29	Avalon Dam - view from outlet works down main canal	to southwest
31	NM-4-B-31	Avalon Dam - outlet works from crest of dam including Spillway No. 1 and cylinder gate discharge portals	to southeast
32	NM-4-B-34	Avalon Dam - view to Spillway No. 1, cylinder gate operating stands and bridge	to northeast
33	NM-4-B-36	Avalon Dam - outlet works and cylinder gates	to west
34	NM-4-B-43	Avalon Dam - north cylinder gate and downstream face of dam	to northwest
35	NM-4-C-4	Main Canal - East Side Canal turnout (left), Wasteway No. 1 (center), and Check Gate No. 1 (right)	to southeast
36	NM-4-C-10	Main Canal - Wasteway No. 1, detail of gates	to northeast
37	NM-4-C-12	Main Canal - Spillway and Wasteway No. 2, Just above Dark Canyon Siphon	to south
38	NM-4-C-14	Main Canal - canal checkgates, just below Dark Canyon Siphon	to northeast
39	NM-4-C-16	Main Canal - Wasteway No. 3 at Cass Draw	to northwest
40	NM-4-C-18	Main Canal - transition from unlined to concrete lined canal	to south
41	NM-4-C-19	Main Canal - Lateral No. 12 C 3, north of Otis	to north
42	NM-4-C-24	Main Canal - Lateral No. 23 1/2	to east

43	NM-4-D-5	East Side Canal - view down canal just below east side canal turnout	to east
44	NM-4-D-7	East Side Canal - CCC stone lining	to west
45	NM-4-E-2	Pecos River Flume - view of west side	to east
46	NM-4-E-5	Pecos River Flume - view of top and east side	to northwest
47	NM-4-F-1	Dark Canyon Siphon - inlet	to east
48	NM-4-F-3	Dark Canyon Siphon - outlet	to northwest
49	NM-4-G-2	Black River Canal - supply from end of main canal to Black River	to southwest
50	NM-4-G-4	Black River Canal - dam	to southwest
51	NM-4-H-1	First National Bank building, Carlsbad,	to southwest
52		McMillan Dam - gate keeper's house	to southeast
53		McMillan Dam - gate keeper's house	to southwest
54		McMillan Dam - garage	to northwest